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Suppose somebody said—

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Makers of high quality lubricants for all types of machinery

the New GARGOYLE

Mobiloil

Make this chart your guide

It shows the correct grade of Gargoyle Mobiloil for certain prominent cars. If your car is not listed below, see complete Mobiloil Chart at your Mobiloil dealer's.

NAMES OF PASSENGER CARS	1929 Engine		1928 Engine		1927 Engine		1926 Engine	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Auburn, 6-66	...	...	...	...	...	...	A	A
" 8-cyl.	BB	Arc.	BB	Arc.	BB	Arc.	A	Arc.
" other models	A	Arc.	A	Arc.	A	Arc.	A	A
Buick	BB	Arc.	BB	Arc.	BB	Arc.	A	Arc.
Cadillac	BB	Arc.	BB	Arc.	BB	Arc.	BB	Arc.
Chandler Special Six	...	...	A	Arc.	A	A	...	...
" other models	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Chevrolet	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Chrysler, 4-cyl.	...	...	A	Arc.	A	Arc.	A	Arc.
" Imperial	BB	Arc.	BB	Arc.	A	A	A	A
" other models	A	Arc.	A	Arc.	A	A	A	A
De Soto	A	Arc.	...	...	...	...	...	...
Dodge Brothers	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Durant	A	Arc.	A	Arc.	...	...	A	Arc.
Erskine	A	Arc.	A	Arc.	A	Arc.	...	...
Essex	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Ford, Model A	A	Arc.	A	Arc.	...	...	...	...
" Model T	...	...	...	...	E	E	E	E
Franklin	BB	Arc.	BB	Arc.	BB	BB	BB	BB
Gardner, 8-cyl.	BB	Arc.	BB	Arc.	BB	Arc.	A	Arc.
" other models	...	...	...	...	...	...	A	A
Graham-Paige	BB	Arc.	BB	Arc.	...	...	...	...
Hudson	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Hupmobile	BB	Arc.	BB	Arc.	A	Arc.	A	Arc.
La Salle	BB	Arc.	BB	Arc.	BB	Arc.	...	...
Marmon, 8-cyl.	A	Arc.	A	Arc.	A	Arc.	...	...
" other models	...	...	BB	A	A	A	A	A
Moon	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Nash, Adv. & Sp. 6.	BB	Arc.	BB	Arc.	BB	Arc.	A	Arc.
" other models	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Oakland	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Packard	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Peerless, 72, 90, 91	BB	A	BB	A	BB	A	BB	A
" other models	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Plymouth	A	Arc.	...	...	...	...	...	...
Pontiac	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Reo	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Stearns Knight, 6-80.	BB	Arc.	BB	Arc.	...	...	...	...
" other models	BB	A	BB	A	BB	A	BB	A
Studebaker	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Velie, 8-cyl.	BB	Arc.	BB	Arc.	...	...	...	...
" 6-cyl.	A	Arc.	A	Arc.	A	Arc.	A	Arc.

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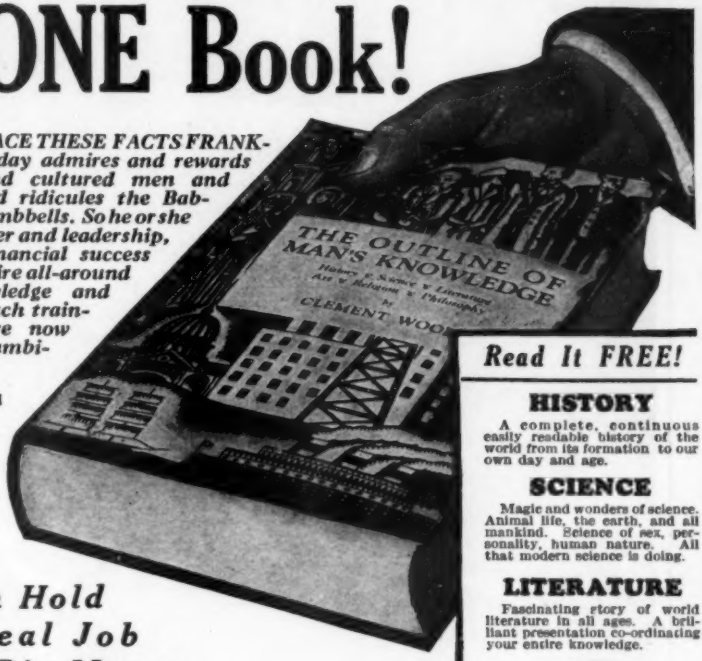

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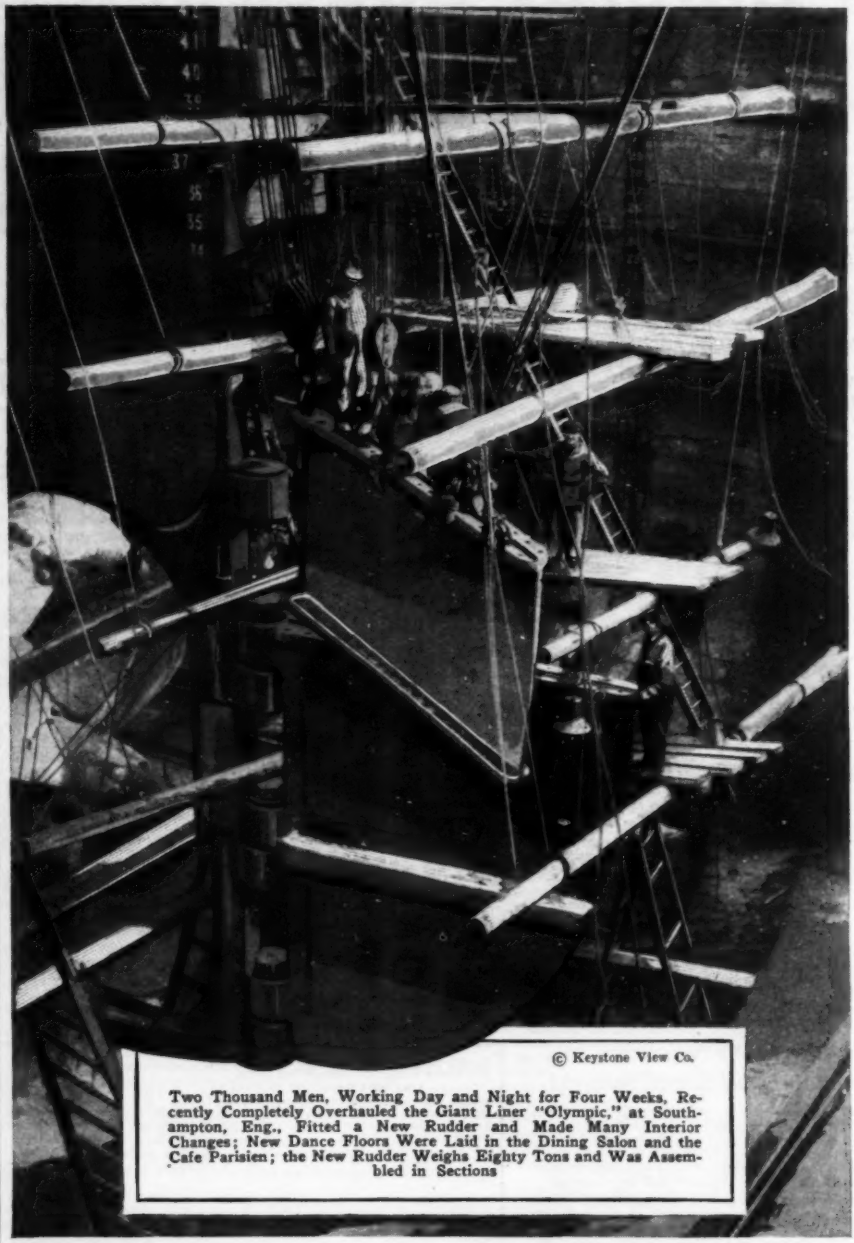
FITTING A NEW RUDDER TO AN OCEAN GIANT



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Two Thousand Men, Working Day and Night for Four Weeks, Recently Completely Overhauled the Giant Liner "Olympic," at Southampton, Eng., Fitted a New Rudder and Made Many Interior Changes; New Dance Floors Were Laid in the Dining Salon and the Cafe Parisien; the New Rudder Weighs Eighty Tons and Was Assembled in Sections

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Hanging 600 Pounds from a Flame

SIX hundred pounds, hanging in mid-air supported only by the energy created by a small gas flame, is the latest spectacular stunt of science. The heat of the flame warms one end of a copper bar, while the other is immersed in cold water, and the result is an electric current so powerful that six boys can stage a tug of war with the magnet and armature without pulling them apart.

Dr. Paul E. Klopsteg is responsible for the most powerful thermo-magnet ever built. That temperature changes can produce electrical energy in metal is not new, for that is the theory on which thermocouples—the electric thermometers used in so many industries—are based. But the energy produced is only a minute fraction of a volt and a minute part of an ampere. In Doctor Klopsteg's new apparatus, with a current pressure of about one fourteen-thousandth of a volt, a current of approximately 150 amperes has been measured.

Doctor Klopsteg and an Assistant, Total Weight 370 Pounds, Held Up by a Heat Magnet Getting Its Energy from a Small Gas Burner

The apparatus consists of a circular magnet of soft iron and an armature of the same shape, each fitted with a strong steel hook. A groove is cut in the face of the magnet to take a loop of copper bar about half an inch square, the ends of the bar projecting through slots in the side. The result is an electro-magnet with a single turn, the copper bar. To the ends of the bar, larger copper plates are soldered, one to be heated by the burner and the other immersed in water, and between the ends is a bar of copper-nickel alloy.

Several German scientists in the past have produced somewhat sim-

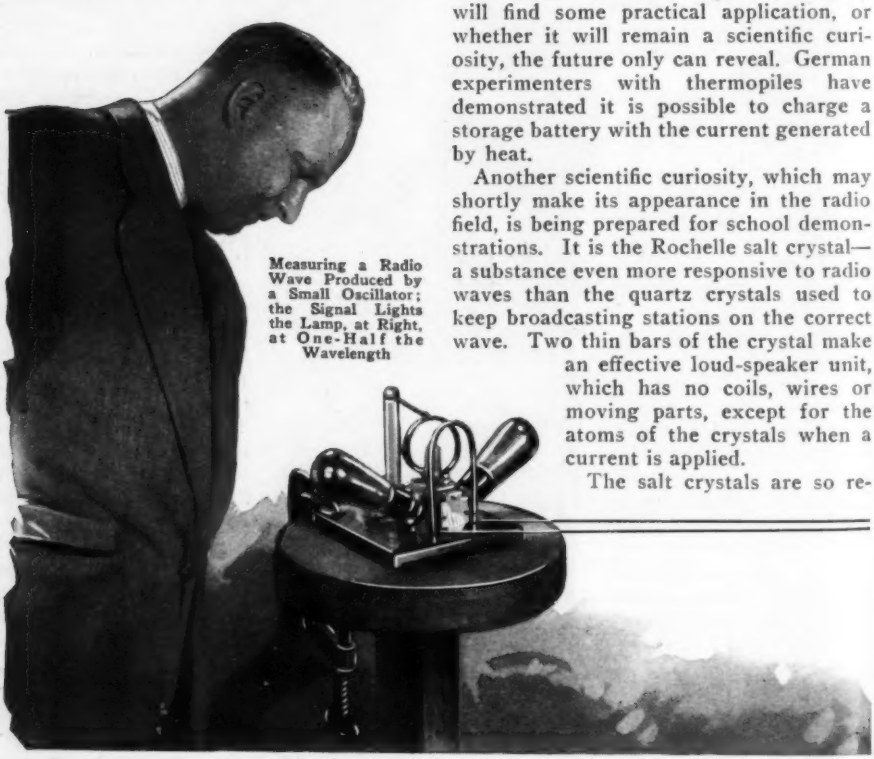
Crystals That Talk and Also Give Electrical Shocks; the Small Device in the Lower-Left Corner Is a Demonstration Unit, Ready to Be Attached to a Cone; It Produces Excellent Volume and Tone

ilar arrangements, but never succeeded in obtaining a lifting pull of more than a few pounds. Discovering that the effect depended as much on the shape of the parts as on the difference in temperature between the ends, Doctor Klopsteg experimented until he evolved a design that would support hundreds of pounds. In testing apparatus, weights up to 600 pounds have been piled on before the armature pulled free from the magnet.

To check the actual current produced against theoretical calculations, which had showed a force of 135 amperes in supporting more than 450 pounds' weight, he designed a small wire coil of 100 turns, to fit into the magnet in place of the copper bar, and, with it connected to a single volt and a half dry cell, was able to support correspondingly heavy loads. As many as three 160-pound men can hang from the armature at one time.

Whether the heat magnet eventually will find some practical application, or whether it will remain a scientific curiosity, the future only can reveal. German experimenters with thermopiles have demonstrated it is possible to charge a storage battery with the current generated by heat.

Another scientific curiosity, which may shortly make its appearance in the radio field, is being prepared for school demonstrations. It is the Rochelle salt crystal—a substance even more responsive to radio waves than the quartz crystals used to keep broadcasting stations on the correct wave. Two thin bars of the crystal make an effective loud-speaker unit, which has no coils, wires or moving parts, except for the atoms of the crystals when a current is applied.



Measuring a Radio Wave Produced by a Small Oscillator; the Signal Lights the Lamp, at Right, at One-Half the Wavelength

The salt crystals are so re-

sponsive to electric current that, by reversing the process and, instead of having the current vibrate the crystals, vibrating them mechanically, an electric current can be produced. Two small crystals mounted for a loud-speaker unit can be made to light a neon test lamp, or produce a strong electric shock merely by tapping them lightly with a lead pencil. By applying the two wires of the lighting circuit to opposite sides of a larger crystal, lying on a table, it is possible to make it vibrate so violently that it sounds like a buzzer.

The crystals are produced by a secret process in a chemical bath. A seed crystal is used as a starter, and more salt is deposited on it through electrochemical action. The finished crystal is nearly as clear as the finest window glass. One of its peculiarities is that it always grows in the shape of a prism, due to the arrangement of the molecules as they are deposited, and another is that the greatest mechanical and electrical effect is across the diagonal of the crystal. For use in loud-speaker units, they are cut on that line. The Rochelle crystals can be manufactured at comparatively low cost.

Doctor Klopsteg's laboratory also has produced a small oscillator for school use to give visible demonstrations of radio waves. One of the uses to which it can be put is the measurement of the length of the radio wave. The oscillator, employing a pair of power tubes and operated off the lighting current, produces a wave of about three and a half meters' length. With a pair of wires stretched across the room from its output terminals, and a small flashlight globe as a test lamp, it is possible to light the lamp at the points of maximum signal intensity, which come at one-half the wavelength, and again at the full wave, wave and a half, and so on.

Doctor Klopsteg with His Heat Magnet, Showing the Copper Single-Turn Coil in the Soft-Iron Housing, and the Two Copper Plates, One of Which Is Immersed in Water and the Other Heated, to Produce Electricity

Two Notable Examples of Floodlighting, a Motion-Picture Theater and the Los Angeles City Hall; the Latter Is One of the Largest Buildings So Treated

FLOODLIGHTING OF MOVIE THEATER DRAWS CROWDS

Effective use of floodlights on the exterior of a motion-picture theater in a California city has helped increase attendance at the night performances, the management reports. The lamps are directed in such a way that the special features of the building, including its tower, are made prominent. Another recent example of attractive floodlighting is that installed at the Los Angeles city hall, which can be seen for miles around at night time, bathed in the soft glow from scores of floodlights.

IMPROVED STEEL HAS SKIN FOR LONGER WEAR

Production of an improved steel that has a skin to protect it against rust and wear was announced recently. The coating is produced by placing the steel in a gas bath at a temperature of 1,000 degrees. This results in the formation of a tough film that is extremely hard and is impervious to rust. It has been asserted that bearings made of this steel seem never to show signs of wear and that they may be run safely though they become red-hot. A number of electric motors, using bushings of the new steel, were tested recently. They were started and stopped by an automatic mechanism and, after 22,000,000 operations, everything but the special steel units had worn out.

PULVERIZED COAL TO RUN SHIPS RIVALS OIL AS FUEL

That pulverized coal is a satisfactory fuel under marine boilers has been demonstrated with the United States shipping board's steamer "Mercer," a vessel of 9,500 tons. On the first trip, the efficiency was ninety-five per cent of that obtained from her best voyage with an oil burner, and the installation cost less.

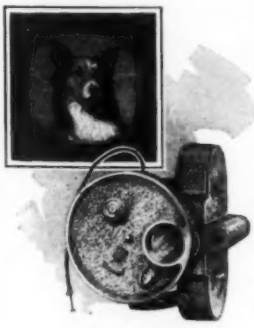
¶Corn is believed to have first been grown in middle America.

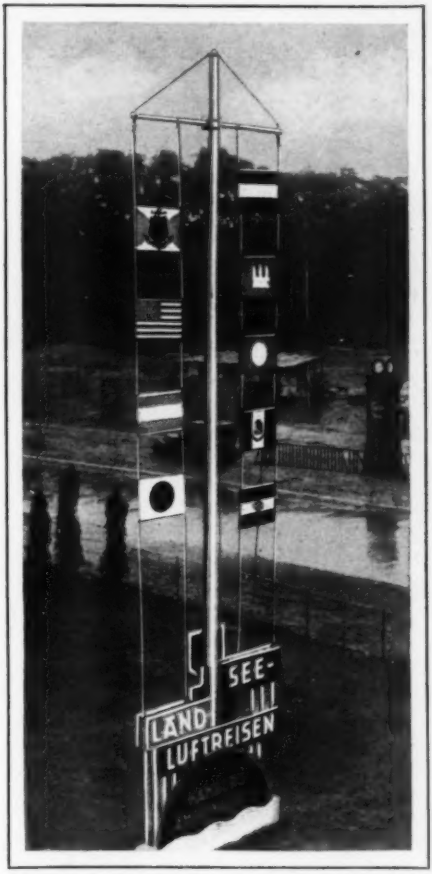
RECORD DISTANCE BIRD FLIGHT MADE BY ARCTIC TERN

The longest flight by a banded bird ever reported to the biological survey was made recently by an arctic tern only three months old. It was banded at Turnevick bay, Labrador, and was found dead on the beach at Margate, Natal, South Africa, less than four months later. The terns are among the greatest bird travelers, for they nest as far north as land has been discovered, arriving in the arctic regions about the middle of June, each year, and leaving about August 15. Several months after their northern visits, the birds are found near the antarctic continent, 11,000 miles distant from the starting point. Experts estimate that the terns cover at least 150 miles a day in their migration flights, although the exact routes are not known. Spending its life at opposite ends of the globe, the arctic tern has more hours of daylight and sunlight than any other animal in the world. In the north, the sun never sets during its entire stay and in the antarctic regions, broad daylight continues throughout its sojourn there.

FADE-OUTS IN AMATEUR MOVIES EASILY MADE WITH DISK

Fade-ins, fade-outs, dissolve and double-exposure effects are easily attained in the amateur motion-picture film with the aid of an automatic disk arrangement, which is said to give results that will compare favorably with those achieved in the professional films. The disk is operated by a clockwork and is simply clamped over the lens. In using it, the time indicator is set, the camera focused as usual, and the fade-in button is pressed simultaneously with the camera button. The disk button is pressed again for the fade-out and the camera button released.



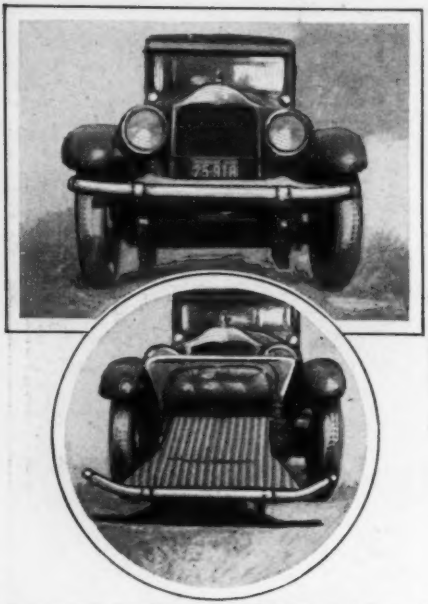


Flags at Flying Field Show How Many Parts of the Globe May Now Be Seen from the Air

FLAGS DIRECT AIR TRAVELERS TO FOREIGN PORTS

How extensively travel by air has developed in Europe is seen at the Templehof landing field, at Berlin, where the flags of different countries to which air lines extend, are hung on a special mast for the guidance of tourists. Several nations are represented, and fast airplanes serve each one. Ticket offices, where transportation by air may be purchased to various parts of the world, are being established abroad and in this country as well.

¶Some of the cables under the Pacific ocean lie six miles beneath the surface.



Bumper Protector Lowered and Raised; the Apron and Pad Shield Pedestrians from Injuries

SAFETY BUMPER FOR AUTOS SERVES ON STREET CARS

To prevent serious accidents to pedestrians, a safety bumper for the automobile and street car has been designed. As applied to the auto, it consists of a drop-apron unit, padded with cushions and operated from the driver's seat. It is lowered in less than a second, regardless of the speed of the car, and is intended to catch the victim in the soft canopy where he is little likely to suffer serious hurt. When folded up, the cushions and apron are out of sight. The device is also closed from the driver's seat, and the bumper unit is made adjustable to different makes of autos, trucks and street cars.

FLOATING FLOORS IN BUILDINGS HELP REDUCE NOISE

By constructing walls in layers, "floating" floors and suspended ceilings, engineers have succeeded in eliminating many bothersome noises in buildings. Tests made by the bureau of standards show that such types of construction prevent the transmission of impact sounds to a marked degree. The experiments were made particularly with regard to the noises produced in walking across floors, and by the vibration of machinery. Introduction of air spaces was effective in curbing the sounds.

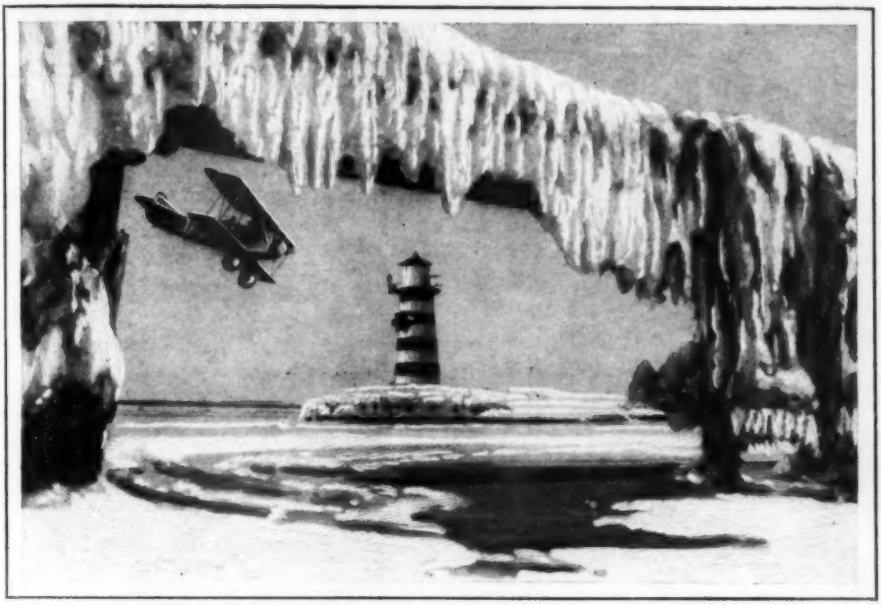
OYSTER-BREEDING IN TANKS TO INCREASE SUPPLY

Successful experiments are being made by British government research workers in breeding oysters in large tanks. Several years of disease have depleted the natural beds and have produced a scarcity of English oysters. One oyster, at the age of six years, can incubate about 1,000,000 young.

ROCKER BECOMES WHEEL CHAIR WITH FOLDING TRUCK

Rocking-chairs are quickly converted into wheel units, for service in hospitals and other places, with the aid of a folding roller truck. It is easily adjusted to the rockers, being adaptable to different widths and requiring no tools, and, when not in use, can be folded into small space and carried in the hand baggage. The wheels are rubber-tired, and there is also an adjustable footrest.

Close View of the Wheel Truck, and Photograph of It in Use with Ordinary Rocking-Chair



Framed in a Natural Setting That Suggests the Severity of the Recent Winter in Europe; One of the Planes Sent to the Relief of the Lighthouse Crew by the German Government

PLANE RESCUES LIGHT KEEPERS MAROONED BY ICE

Rescuing keepers of lighthouses by air is an uncommon occurrence. Such a rescue was effected last winter. Due to the ice blockade, keepers of the light at Warnemunde on Mecklenburg bay, Germany, were marooned and unable to obtain supplies. The government sent an airplane to their relief with food and other materials which were dropped where the lighthouse tenders could get them.

DIAMOND MINES IN ARKANSAS PRODUCE RARE GEMS

Although most of the diamonds found in the Arkansas mines are small, many of them are of unusual beauty and brilliance, and, occasionally, stones of considerable size are discovered. In 1917, a canary-colored diamond, weighing eighteen carats was found. The Arkansas fields, opened in 1906, cover about sixty acres. Diamonds are found in the mountain ranges of northern California and southern Oregon, but not in quantities to justify commercial development. Some years ago, a diamond weighing more than twenty-three carats was found in Virginia and a large black crystal, unearthed in North Carolina and broken by an inexperienced mineralogist, proved to be a black diamond.

SALT ON WINDSHIELD WIPER HELPS CLEAR GLASS

Inclosed in a brass holder on the windshield wiper is a bar of material, chiefly salt, which helps melt ice and frost that form on the glass. The bar will last for about six hours of wiping and, when not in use, is carried in the tool kit. New salt bars are easily inserted in the brass holder when needed.

The INVISIBLE

"NUMBER 7 cruiser. Number 7 cruiser. 3327 Gratiot avenue. A haberdashery holdup. 3327 Gratiot avenue."

The voice, coming from a little black horn behind the front seat, sent the big police car roaring through the night. Down startled streets, the car crunched to a stop in front of the store. A police sergeant and two men leaped out. The amazed proprietor and a customer, victims of the holdup, had hardly recovered from the shock of the gunman's visit. The cash-register till was open and empty, just as the bandit left it. He had won his escape by the narrow margin of seconds!

You are on a night tour with "Cruiser No. 7," one of the fleet of nine radio-equipped cars that the city of Detroit is sending against the criminal. In the first 227 days of its operation, this remarkable fleet effected 551 arrests for major crimes, recovered thousands of dollars' worth of stolen property, caught criminals literally red-handed in the act of committing crimes, or endeavoring to conceal them, and spent, on the average, just seventy seconds in reaching the scene of the crime after receiving the first report by radio.

Not long ago, a burglar alarm sounded from one of the city's largest office buildings. Elevators were stopped and doors were closed. Three minutes after that, the building was surrounded by policemen. Five of the radio cruisers had picked the alarm out of the air as it was relayed from the broadcasting station W8FS on Belle Isle, miles away. In all, seventy-one policemen responded in a matter of a few minutes.

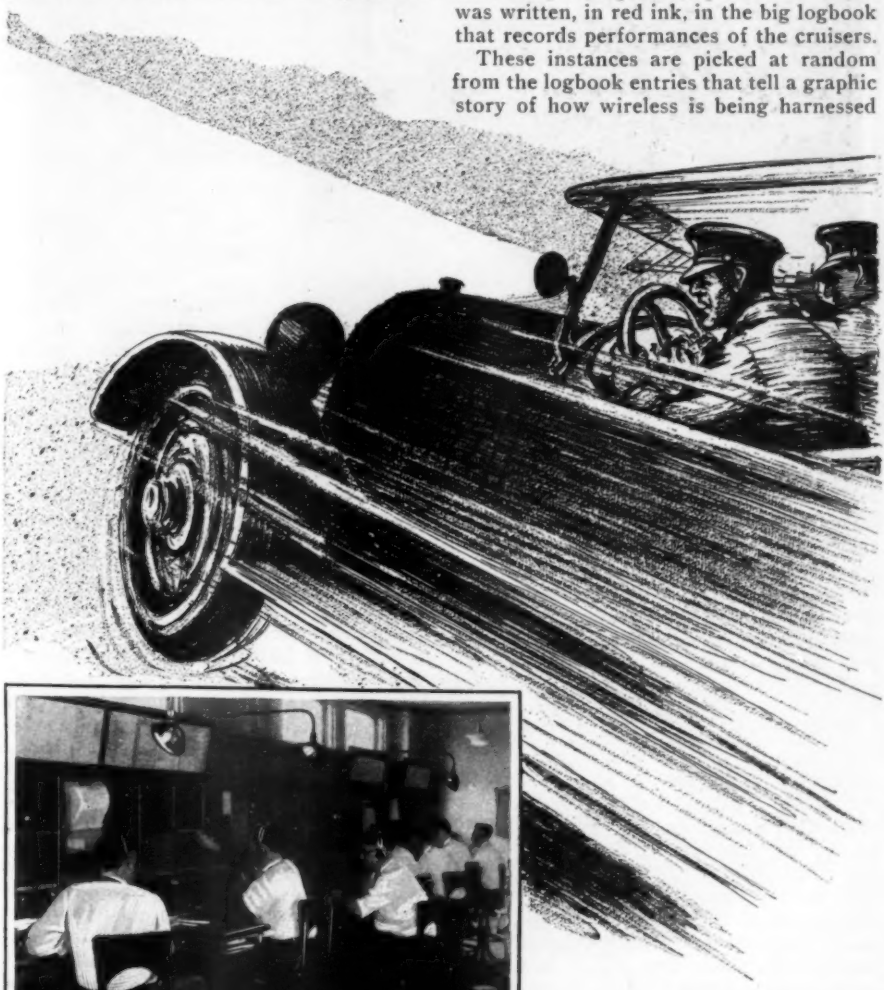
Quick work by a boy and the radio resulted in the rout of a bandit crew just the other day. One of the alleged robbers was shot and killed in the fight with the police. The boy saw the holdup in a

MAN HUNTER

store. He called the police, then watched the bandits who entered a cab. He saw the number on the license plate and telephoned that information to headquarters.

A cruiser squad, receiving by radio news of the robbery, encountered the cab a few blocks from the scene and another creditable entry for quick response and arrest was written, in red ink, in the big logbook that records performances of the cruisers.

These instances are picked at random from the logbook entries that tell a graphic story of how wireless is being harnessed



Where Police Alarms Are Received and Relayed; View of the Main Board in the Detroit Police Headquarters; the Man Second from the Left Is the Chief Dispatcher Who Relays Proper Calls Directly to the Broadcasting Station

Sgt. Kenneth R. Cox, Chief of Detroit's Radio Police Broadcasting Station, Working on One of the Portable Receivers

to aid in the fight against crime, and how it is putting speed into the arm of the law. The radio announces the misdeeds of the criminal to the whole world. The voice of W8FS has been heard abroad. A station in Germany picked up a crime report at the same moment the local crews were speeding to the scene. However, this was unusual, for the station broadcasts on a low wavelength that is calculated not to disturb other stations.

Here is what happens when a crime "breaks." The alarm or telephoned report reaches an operator at the main board in headquarters and is instantly relayed through a loud-speaker telephone to the radio station at Belle Isle, where one of the operators throws a switch that puts the set on the air. The word to the cruiser squad thus goes out without repetition, directly from headquarters. Arrived at the scene, the cruiser men make an immediate report back to the inspector at headquarters and their radio station. A shorthand reporter jots down the conversation and condenses it into a bulletin which is then typed on a marvelous machine, the teletype. It operates somewhat like a stockbroker's ticker. As the message is written, the words are duplicated on receiving machines in each of the city's precinct stations, signal, traffic and motorcycle bureaus and at the radio station also. The radio operator there then broadcasts the teletype message so that all the cruiser squads will have the latest developments of the crime.

In case of a general alarm, word is relayed to suburban police stations. Four bells sound in each of the offices, and the operator at headquarters in Detroit reads off the teletype message. At the same time, the police operator at each of the precinct stations presses a switch that lights the patrol boxes in his territory. When the green light flashes on the box, the patrolman on duty near by is required to open the box and listen to the operator's message. The lights remain on until patrolmen on every beat have been reached. They check in by giving their badge number as they receive the word.

By this system, a net can be flung over a radius of 100 miles or more within a few seconds after a crime has been committed. Plans are now under discussion whereby intercity communication can be carried on so that cruiser squads in other cities or radio-equipped machines operated by state police departments, for instance, would have immediate word of the crime and be on the lookout for fugitives.

Radio in police work is not new, but until recently, it has been chiefly experimental and in some cities a failure. Results were disappointing in Detroit up to April 7, 1928. But that date marked a new day in the city's radio department and brought to light an interesting story. Radio fans in the police department had watched the unsuccessful operation of the system with concern and disappointment. When it was suspended and the station,

Interior View of Broadcasting Studio of Station WSFS and Glimpse Inside of One of the Cruisers, Showing the Set

then KOP, closed in 1927, their regret was keen. Patrolman Kenneth R. Cox, one of the wireless experts, went to Commissioner William P. Rutledge with an explanation as to why he believed the radio apparatus had failed Cox and two other young radio fans, Policemen Bernard Fitzgerald and Walter H Vogler, were commissioned to remedy the situation They decided that the chief trouble lay in the transmitter. It was down town on the police headquarters building where it was hedged in with steel skyscrapers. So the set was completely rebuilt, adjusted to work on a wavelength of approximately 150 meters instead of 200 and moved to Belle Isle. The old receiving sets were abandoned

for new ones that the station staff designed. They were built into steel cabinets designed to fit back of the front seats of the police cars. The receiving sets work only on the wavelength of the police broadcasting station so that they cannot be used for other purposes. So successful has been the performance of the entire system, the direct result of a hobby on the part of Sergeant Cox and his associates, that radio-equipped cruisers are contemplated for every precinct in the city and sets are planned for smaller "scout" cars as well.

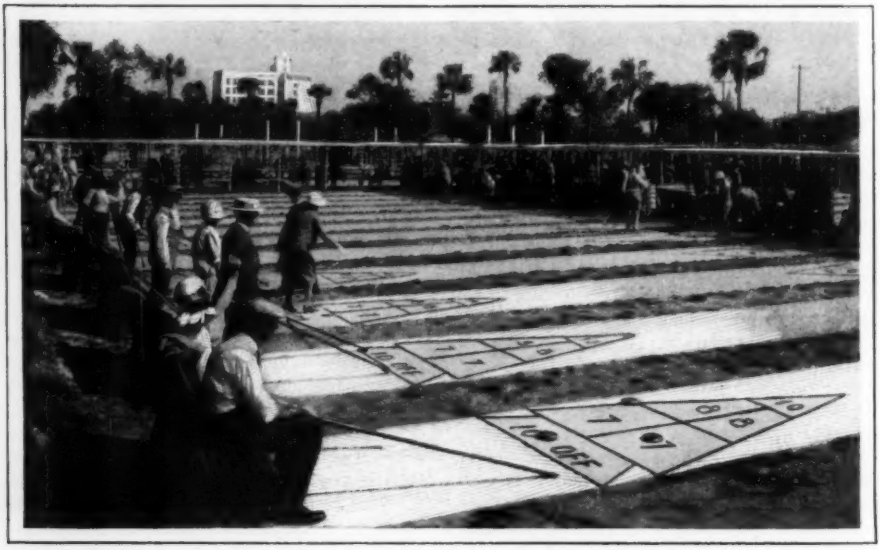
Back and forth through the silent streets, the cruiser car and its alert crew keep constant watch over the district until two o'clock in the morning, when the shift is over and the broadcasting station is silenced for the day. Normally, each car will travel from sixty to ninety miles during a single shift. Every half hour, the operator at the station sends out a test announcement to determine if all the receiving sets are working. If the men in the cruisers do not hear the test call at the scheduled time, they immediately notify the station so that repairs can be made. Up to the middle of February, before the system had been in operation a year, there had been but three failures of the receivers. During that time, the station sent out more than 20,000 calls.

SEAWEED PADDING IN AIRPLANE DECREASES NOISE

By packing walls and ceilings of cabin airplanes with a special variety of seaweed, an effective way has been found to reduce the sound of the propellers and the motors. The weed is also being employed successfully in the insulation of homes.

FAVORITE STEAMER-DECK GAME NOW PLAYED ON LAND

Shuffleboard, one of the most popular of the games played by ocean travelers, is now enjoyed on land at a Florida resort. A smooth concrete court, properly marked, has been provided and many players can be accommodated at once. The game, now essentially the same as it was when it was played in England in the fifteenth century, consists in shooting wooden disks upon a scoring diagram with a cue and, at the same time, of course endeavoring to prevent the opponent from winning a tally.



Playing an Ancient Ship-Deck Game on Dry Land; Shuffleboard Court in Use at a Florida Resort; Many Players Can Be Accommodated at One Time; the Surface Is Smooth Concrete

© P. & A.

Rocket Sled at Full Speed, and a Close View, to Show the Arrangement of the Ski-Shaped Runners; Sixty Miles an Hour Was the Rate during a Test

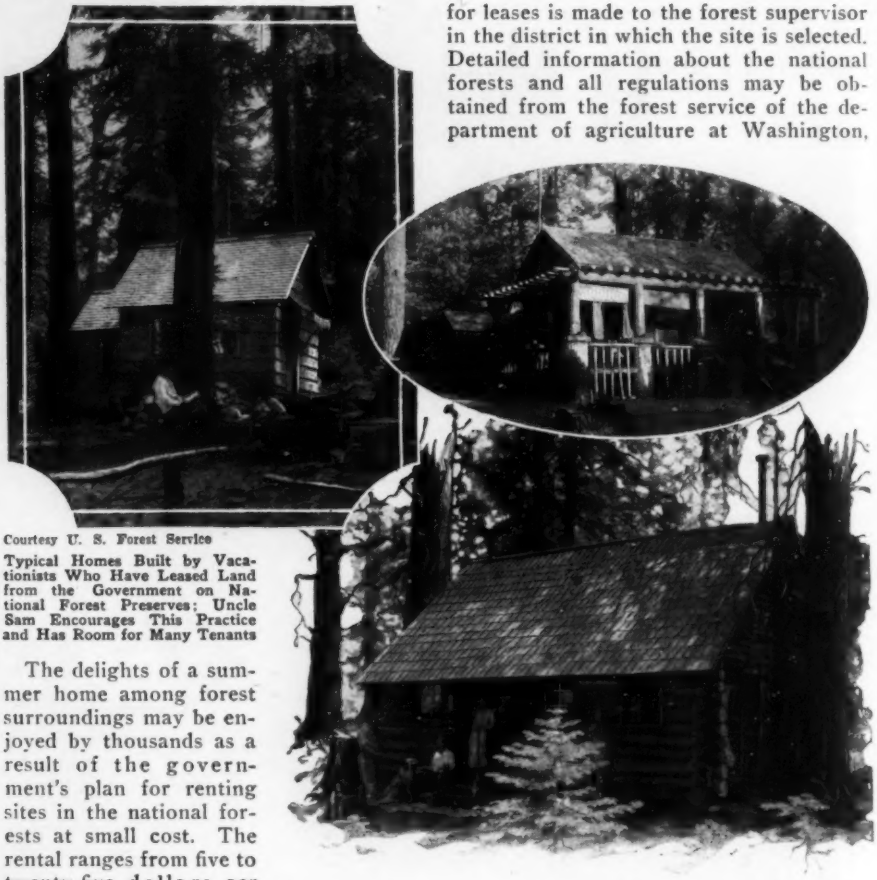
ROCKET-DRIVEN SLED MAKES HIGH SPEED

Speed of more than sixty miles an hour was developed by a rocket sled, tested on a lake in the Bavarian Alps last winter. The manner of propulsion is essentially the same as that of the wheeled vehicles which have been run by harnessing the force of exploding powder. To show how simple the powder vehicles are to operate, a woman piloted the sled during one test run.

RADIO HELPS TO FIND MOTOR THAT SUNK IN LAKE

Already used with considerable success in prospecting for oils and metals and seeking buried treasure, radio has scored another triumph in finding lost articles. Not long ago, a friend of Prof. A. M. Skellett, of the University of Florida, had the misfortune to lose an outboard motor in Orange lake, near Gainesville. Professor Skellett, who is also electrical engineer for radio station WRUF, rigged a "treasure hunter" somewhat like a small transmitting set and, with his friend, rowed to the approximate location where the motor had dropped. The apparatus was lowered into the lake and the current turned on. As the set was towed along, the hunters kept careful watch of a meter attached to it. Presently they noticed a marked decrease in the strength of the current, indicating approach to a body of metal. A brief further search, and the engine was found. The motor was raised and soon put in running condition again.

SUMMER HOMES IN NATIONAL FORESTS FOR ALL



Courtesy U. S. Forest Service

Typical Homes Built by Vacationists Who Have Leased Land from the Government on National Forest Preserves; Uncle Sam Encourages This Practice and Has Room for Many Tenants

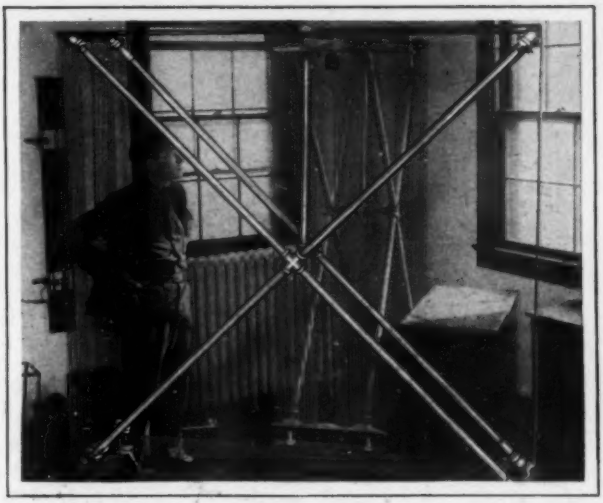
The delights of a summer home among forest surroundings may be enjoyed by thousands as a result of the government's plan for renting sites in the national forests at small cost. The rental ranges from five to twenty-five dollars per year, depending upon the location, and the leases run from one to fifteen years, when a renewal is necessary. Improvements may be built as desired, but plans for houses and other buildings must first be approved by the forest officer; the strict regulations against fire must always be observed, and certain rules of sanitation must also be obeyed. Sites are available in all of the national forests with the exception of the White Mountain forest in New Hampshire and Maine and the Wichita in Oklahoma. They include many hundreds of thousands of acres. In some areas, logs for building, fencing and firewood are furnished free. Application for leases is made to the forest supervisor in the district in which the site is selected. Detailed information about the national forests and all regulations may be obtained from the forest service of the department of agriculture at Washington, D. C. The plan applies also to the national forests in Alaska and Porto Rico.

CHEMICAL PROCESS KEEPS FISH FRESH FOR ONE MONTH

Fish are reported to be kept fresh for a month and at low cost by a chemical process developed in Norway. The method requires a boiler, a pump and a tank. The tank is filled with water, either fresh or salt, which is heated with steam to a certain temperature, when various chemicals are added. The solution is then allowed to cool and the fish are soaked in it for one or two hours.

ANTS FIGHT FIRES TO SAVE THEIR NESTS

Further demonstrations of the remarkable abilities of ants have been observed in a series of experiments performed in France. The tests disclosed that the ants, of the common red variety, become accomplished firemen when necessity demands. The discoveries were made as the result of an accident. A laboratory worker was in the habit of tossing lighted cigaret stubs into an ant-hill which had been partly demolished. He noticed that the stubs went out more quickly on the hill than when thrown on the ground near by. Investigation showed that the ants were extinguishing the stubs. They crowded about the glowing cigaret and ejected an acid fluid of some sort until the embers were entirely extinguished. A lighted candle was placed under the hill. Great numbers of ants immediately swarmed about it, formed into squads and finally scaled the candle. Then, at the risk of their lives, they proceeded to put out the flame by ejecting the fluid. Several ants were fatally burned in the operation. Observers witnessed attempts on the part of the ants to rescue one another, some appearing to prevent others from taking part in the fire fighting. The first candle was snuffed out in three minutes, but as the ants became more experienced, they learned to extinguish the flame in ten to thirty seconds. When the test was applied to ants in other hills, where the occupants had had no experience in handling fires, confusion and evident panic resulted.



Courtesy Harris & Ewing

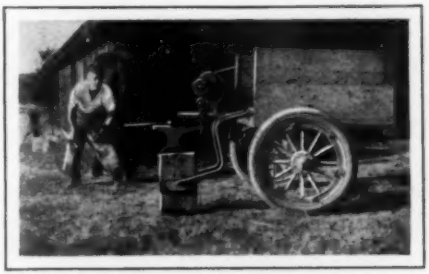
View of the Static Apparatus Which Gives Weather Experts Indication of the Approach of Storms

STATIC HARNESSED TO AID IN WEATHER FORECASTS

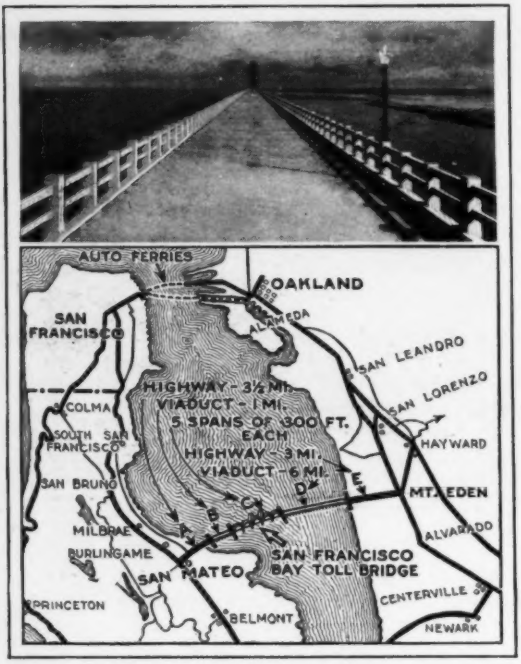
Static electricity has been harnessed by the navy department in making weather forecasts for the benefit of aviators. The apparatus used consists of two six-foot radio loops which pick up static signals in such a way that the experts can derive from them the approach of storms.

BLACKSMITH SHOP ON WHEELS SAVES FARMERS' TIME

Farmers near Eugene, Oreg., do not have to drive their horses to town when the animals need shoeing, for a traveling blacksmith shop serves the community. The outfit is carried in a trailer behind an automobile and includes a portable forge, anvil and other necessary equipment. The work can be done in the fields, at the farm yard or in any other convenient place.



"The Village Smithy" Now Rolls on Wheels; View of the Traveling Shop and Owner at Work



View of the Partly Completed Viaduct, and Map to Show Its Location across the Bay

SEVEN-MILE BRIDGE OVER BAY REDUCES TRAVEL TIME

Cities in northern and central California have been moved nearer to San Francisco by approximately twenty minutes as a result of the seven-mile bridge spanning the bay from Mt. Eden to San Mateo. The viaduct has space for three lines of traffic and has one lift span to permit the passage of ocean-going vessels through the ship canal. Oyster shells, dredged from the bay within a mile of the bridge site, were used in making the concrete, and the work was expedited by precasting the units for the bridge and then fitting them in place.

MOST ACCIDENTS IN FLYING LAID TO PILOTS

Of the 1,062 airplane accidents during 1928, in which 368 persons were killed and 322 severely injured, more than half were due to personnel, according to data collected by the aeronautic branch of the department of commerce. Poor technique, errors of judgment, disobedience of orders, carelessness and negligence were accountable for most of the mishaps in which the operators of the planes were directly involved, it was found. Less than twenty-two per cent of all the accidents were laid to material failures. A total of 349 accidents occurred to airplanes driven by unlicensed pilots, and, of all the accidents recorded, only eighty-five occurred to planes flying regular schedules from airway to airway.

RADIO FACSIMILES SPEED NEWS REPORTS

Successful transmission of the front page of a newspaper by radio was made in London recently during a test. The whole page was flashed through the air from New York city to a London office. The entire operation took but twenty minutes. By this system, it is now possible to send pictures and messages at the rate of 1,400 words a minute.

Facsimile Sent by Radio from New York to England on Special Low-Wavelength Transmitter

Radio Antenna Installed on Plane of London Air Line; the Three Wires Are Permanently Attached and Do Not Have to Be Reeled Up When a Landing Is Made

THREE-WIRE AIRPLANE AERIAL ELIMINATES WINDING

Airplanes on an English line are being equipped with permanent radio aerials, stretched between the wings and the tail. This arrangement is reported to have given satisfactory service in all kinds of weather and also eliminates the task of having to wind the wires up before a landing, a necessary precaution with aerials that are simply suspended from the ship.

ELECTRIC SHOCKS DIRECT ACTOR IN TALKING FILMS

Actors are literally shocked into good performances for the talking films, through an arrangement that has been developed at a western studio. Impulses are silently transmitted from a battery under the carpet, so that signals can be sent without the need of spoken directions or other sounds that would spoil the record on the sensitive receiving apparatus. The idea was inspired by an old trick of the mind reader who sent messages to his confederate by shocks in code.

FAN HIDDEN IN CHANDELIER IMPROVES VENTILATION

Concealed at the base of the electric chandelier, a fan is said to give better ventilation and more effective circulation of the air at less cost than the usual unit. The blades are specially designed to provide a cooling breeze of ample volume and direct the air at a wide angle so that it will not annoy persons below or disturb papers on a desk.

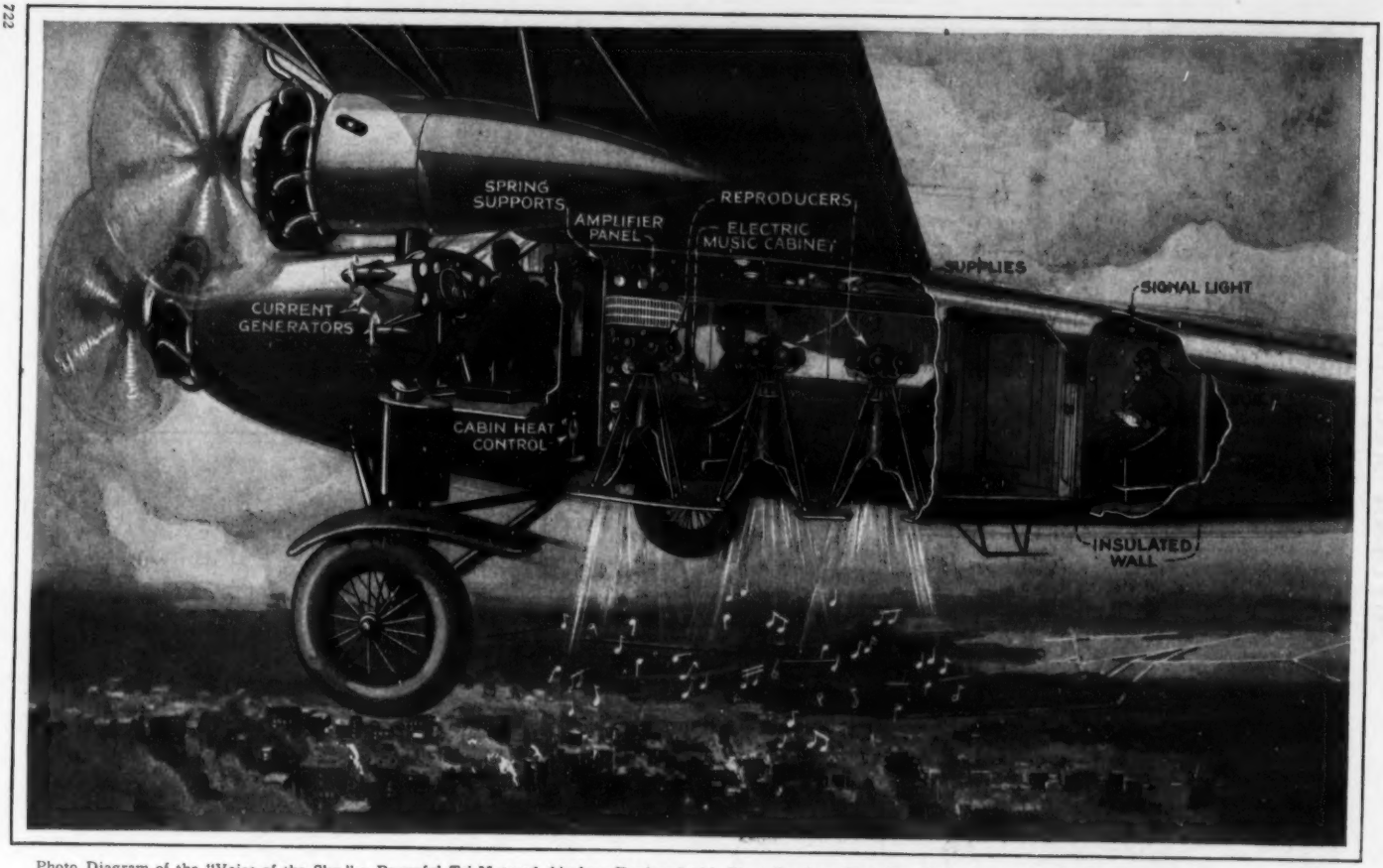


Photo Diagram of the "Voice of the Sky," a Powerful Tri-Motored Airplane Equipped with Giant Speakers That Can Make Its Announcer Heard on the Ground Far Below; a Portable Talking Machine Held in the Operator's Lap Provides Music

With an Enormously Extended Lower Wing, This Big Ship Has Carried a Neon Sign over Several Cities; Note the Cluster of Inspection Mirrors Projecting beneath the Fuselage

Photo Diagram of the "Voice of the Sky," a Powerful Tri-Motored Airplane Equipped with Giant Speakers That Can Make Its Announcer Heard on the Ground Far Below; a Portable Talking Machine Held in the Operator's Lap Provides Music

Flying Electric Billboards and Talking Airplanes Introduce Novelty in Outdoor Advertising

By PAUL D. PADDOCK

IT WAS two degrees below zero and he was in the middle of the street, but the man stopped to listen to a voice that seemed to be coming from the sky.

"Don't let your car freeze," it said cheerily.

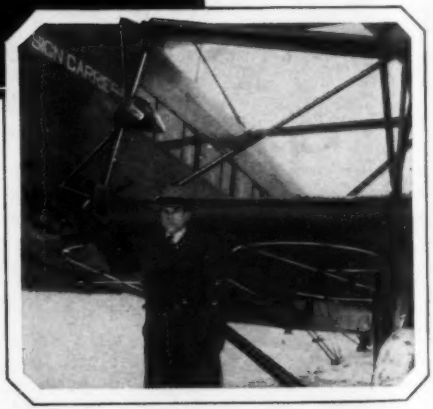
The voice was coming from the sky! From a height of 3,000 feet, it was booming down, echoing in the streets, entering homes and closed cars, warning the motorist to repel the cold. The town crier of the twentieth century, the "Voice of the Sky" was aloft.

This marvelous five-mile voice—it actually has been heard that far and farther—is already familiar to millions but few know how a man can speak so clearly and so loudly from a roaring, tri-motored airplane, half a mile in the air and speeding along faster than the fastest train. Take the extra seat in the cabin and watch what goes on.

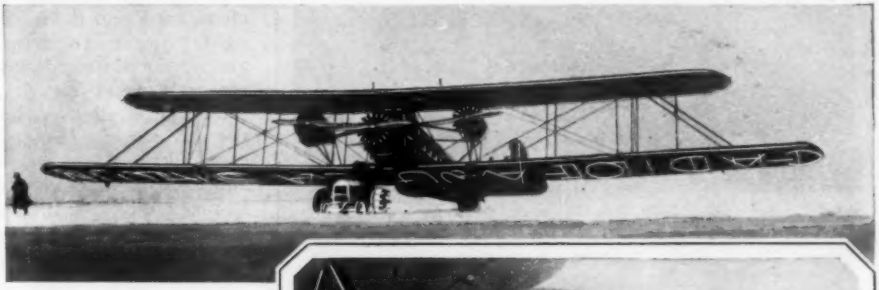
You are in a combination studio, laboratory, generating and broadcasting station, but the voice is not sent by radio. The startled citizens of the city below you, are hearing sound waves directly from the human throat except that the tones have been tremendously amplified. The seats on the left side of the cabin have been removed and, in their place, are three huge horns. Their bulging mouths open out on the underside of the fuselage. On top of each of these horns, are nine of the most powerful sound-reproducing units in the world, making twenty-seven in all. Each is pouring out the voice from the amplifying set, which is at the right of the door that leads to the pilot's compartment. Cooped up in a tiny booth, thickly insulated against the roar of the motors, is the actual source of the mighty voice, a young man, calmly speaking into a microphone. His words travel along

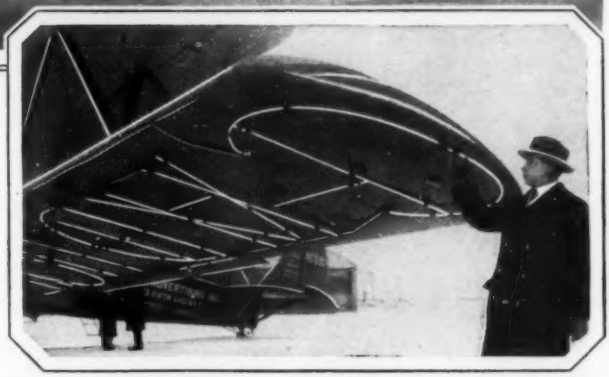
the little wire from the "mike," pass down through the amplifying set, into the reproducers and emerge from the big horns. By the time they leave, they have been magnified in the ratio of 1,600,000 to one. That is another way of saying that the voice of the one man has become greater than the combined shout of a huge army. The single speaker could drown out a stadiumful of college rooters. These sound vibrations are so powerful that, in ground tests, butterflies and other insects flying close to the horns were killed, small birds became stupefied and human beings became nauseated after a short exposure at close range. Such effects, of course, could not be produced from a moving airplane or at the lofty altitude at which you are riding.

Pilot Lew Gower eased the three whirring motors and the majestic Fokker with its six-ton load of gasoline, men and machinery, dipped from a graceful left bank and leveled off. He signaled "ready" by a downward jerk of his right arm to G. W. McCauley, crew chief and inventor of some of the plane's interesting equipment, who was seated before the control panel of the amplifying set. The panel is swung from special spring supports to deaden the shocks and vibrations. Electric current is generated by four little snub-bladed propellers, two tiny blurs on either side of the plane. These units are among the most amazing parts of the entire ship. They are driven by the wind and are so regulated that they spin at exactly so many revolutions per minute, no matter how fast the wind may be blowing or how rapidly the plane may be traveling after it has gained the speed that gives the propellers their proper momentum. The secret of their remarkable performance is an arrangement of weights and balances that give the propellers a slight twist if the speed should increase, regulating the pitch of the blades so that they cannot turn too fast.



Close-Up of the Inspection Mirrors; the Control Cabin of the Neon-Light Plane, and the Light Tubes on the Lower Wing





The Tri-Motored Bomber Rebuilt with an Enormous Lower Wing, to Carry the Neon Sign, and a Close-Up of the Glass Tubes

McCauley lifts a portable electric cabinet upon his knees, adjusts an electric record and sets the needle, which is held in a patented clasp that keeps it in the record grooves no matter at what angle the ship may sway and regardless of any bumps or vibrations. If necessary, this strange music box could be placed upside down on the ceiling and played without allowing the needle to fall from its path. The unit is plugged into the amplifier panel and the sprightly strains of a jazz orchestra go ringing down through the frosty air. Next, a short, sharp bugle call from a record. Then McCauley pulls out the music-box plug, tickles a small switch, and a little light flashes in the "padded cell" at the rear of the cabin, where Bert McGrath, who provides the actual voice and who probably has talked directly to more persons than any other living man, is seated at the microphone. "Hello," his voice booms out. "This is the 'Voice of the Sky.'" The tones fill the cabin, rivaling the drone from the three busy motors, although only a tiny fraction of the sounds' volume reaches the interior. The deeper notes cause the floor of the fuselage to vibrate. The effect is as though the plane were sliding over rough ground.

The voice continues for fifty seconds, when Gower gives another signal. The plane has sped from one end of a city suburb to the other. Now it is to turn back, just as a farmer turns his plow, for another "furrow" of sound. McCauley touches the switch to signal McGrath to stop talking, for the voice is not broadcast on the turns, the chief reason being that, when the ship banks, the horns are at an angle that would send the sound out into space instead of down upon the ground where it is wanted. The earth below seems to dip and wheel slowly about as the plane sends one wing deep down over the city, the other high into the blue of the open sky, seems to hesitate for an instant, and then settles down for another even flight over the wondering land below.

Again the signal from Gower that he is above "location" and has slackened speed slightly for a rate of sixty miles or so, as this pace is required in order that the messages may be heard more clearly. In twelve minutes, every section of the suburb has been covered. McCauley gives another signal, and now McGrath steps out of the broadcasting room to get a breath of fresh air and to stir about a bit during the cross-country dash for the next

Another Kind of Aerial Advertising; Painting a Word across the Sky in a Trail of Chemical Smoke

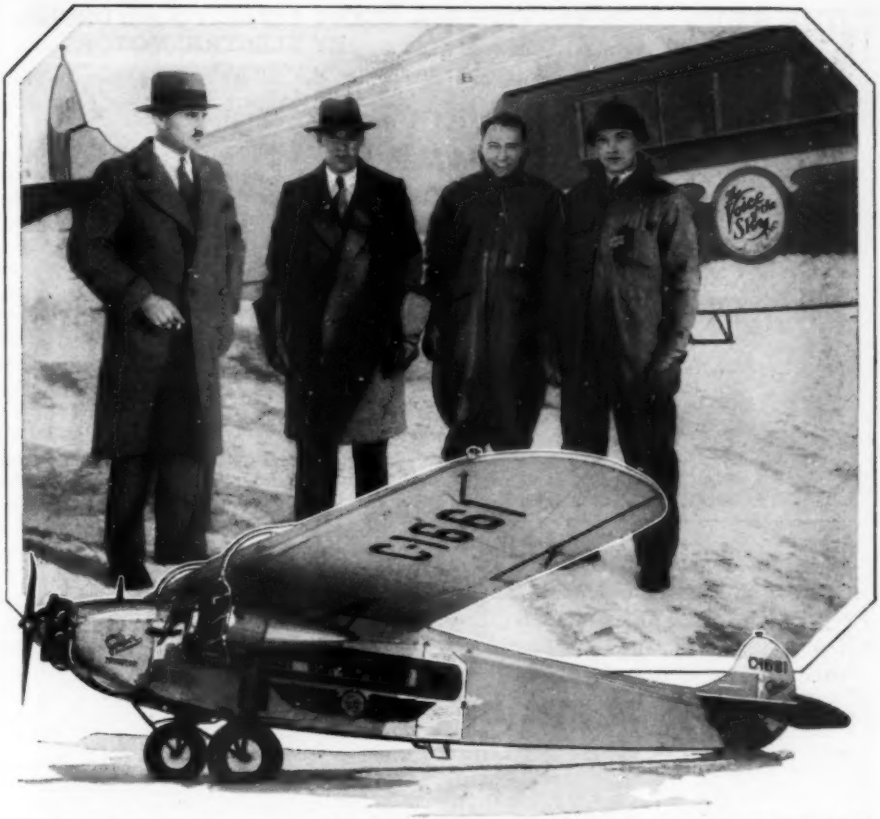
town. While shut in the booth, he cannot see out, for the compartment is tightly closed to exclude every sound but his voice from the sensitive microphone.

For twenty-two minutes, the plane soars over another city while the mysterious voice continues. Skaters halt on the ponds and stare up to listen, their faces tiny blurs against the ice. People come running out of their houses. Another dash across silent farm lands and the golden glaze of sun upon icy snow, and the voice is over a village. Like a huge, persistent bee, the big plane buzzes back and forth. Then away again for a dash at ninety miles an hour to the next audience. McCauley has made a minor repair of the microphone and has relieved Gower at the controls for a few moments while the set was not working. This is a versatile crew. All its members are flyers, inventors and skilled trouble shooters as well.

As the sun slips into a cloud bank and the night lights begin to wink among the cluttered skyscrapers of the big city, the voice is silenced for the day and the Fokker snorts home to the warm and welcome hangar. At 5:15, exactly four hours and sixteen minutes since the ship hopped off, the big propellers stop on the landing-field runway. In those few hours, the voice has spoken to at least 1,000,000 persons, the plane has winged through 300 miles of zero air, and ten cities have been visited. Not a bad afternoon's work, although covering as many as thirty towns in a single day is not uncommon for this electric-lunged crier of the skies.

The plane, now in the hands of Mechanic H. E. Wendt, who usually accompanies the ship but remained at the hangar this time to make cowling for the motors, is one of three equipped to sing, play and speak from the skies. Years of research and a fortune are back of the apparatus that has made the sky voice possible. There was the problem of amplification. How to adjust the big air-cooled tubes and other delicate parts of the set. How to rig the generating system that supplies 2,500 watts of current at the necessary voltage and amperage to give the required results. How to build those small miracles, the generating propellers, so that they would keep a constant speed, regardless of wind conditions. Before the wind-power apparatus was used, an air-cooled engine was employed inside the cabin with a big scoop at the side to permit an inrush of fresh air. But the motor was a risk, it produced unpleasant fumes and did not perform as dependably as the tiny propellers.

The future possibilities of this idea are



The Operating Crew of the "Voice of the Sky" Standing beside Their Ship, and, Inset, the Three-Motored Fokker; the Loud Speakers Project through a Hole in the Cabin Floor

just beginning to be seen. In time of flood or fire, it could be utilized for warning whole communities. An entire army could be directed from the sky. Commanding officers could speak in code that the enemy would not understand.

The "Voice" was hauled into the hangar just as the three big motors of its friendly competitor in this new age of advertising from the skies, a huge biplane, equipped with neon gas tubes that automatically flash three different legends in glowing color from the underside of its lower ninety-four foot wing, were being warmed up for its brilliant journey over Chicago by night. This ship, although voiceless, is an interesting complement to the town crier that cruises the sky by day. The idea of using neon gas lighting from an airplane for advertising purposes, has been developed by Roland Rholfs who pilots the huge ship, a remodeled army bomber. Wind-driven propellers generate 8,000 volts of alternating current to operate the tubes which are protected with specially devised shock absorbers to prevent breakage at landings. The plane is equipped with a system of special lights and flares to be used in emergency descents or should the landing field lights fail. It had 450 feet of glass tubing that spelled three different signs to herald the name of two well-known makes of automobiles. According to Albert H. Miller, who watches results after a trip of the "Voice," sales of a popular brand of cigarets increased nearly fifty per cent everywhere in territory recently covered.

Ball Container for Golfer's Bag; Pressure on a Spring Trigger Releases One Ball at a Time

GOLF-BALL TRIP GUN ON BAG SAVES PLAYERS' TIME

Attached to the outside of the golf bag, a "gun" that holds twelve new balls and releases them one at a time as they are needed, by pressing the thumb on a spring device, saves the player time in looking for new balls. It protects the spheres from damage and loss, is always in position for use and does not interfere with handling the bag in the usual way. Old balls are kept in a container on the inside so that they do not become mixed with the new ones.

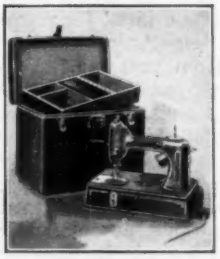
OILED COVER ON ELECTRIC WIRE SIMPLIFIES INSTALLATION

Electric wiring, covered with an oiled rubber preparation in colors, is now on the market, to simplify the task of installation and alteration of home and building circuits. The lubricated feature enables two men to pull a line through a building as easily as four men could with the ordinary wire. By the colors the electrician easily picks out the line on which he is working. This principle has been used for some time in telephone and motor construction, and has just recently been adopted in the building field.

GIANT LINER TO BE DRIVEN BY ELECTRIC MOTORS

When the White Star line puts its first big post-war liner into service, it will be not only the biggest ship ever built—1,050 feet in length and displacing 60,000 tons—but also the biggest electric-driven ship. This type of drive, pioneered by the American navy in battleships some years ago, has been applied to the 17,000-ton liner "California" and the "Virginia," now building, both under the American flag, and in the new 19,000-ton P & O. liner "Viceroy of India," recently launched in England. The White Star ship, on which work has been started at Belfast, will have four boiler rooms, the aftermost of which is shown in the foreground of the artist's drawing. Oil fuel, with automatic firing, will be used. High-pressure water-tube boilers will be fitted with forced draft of preheated combustion air. In the main engine room, seen beyond the boiler room, the steam will drive turbo-generators at about 3,000 revolutions per minute to generate the electricity for the driving motors, directly connected to the propeller shafts and revolving at about 100 revolutions per minute. The electric drive has many advantages, including ease in maneuvering, quickness of reversing power, and the fact that the propellers cannot race when thrown clear in heavy seas.

SMALL-SIZE SEWING MACHINE CARRIED WITH ONE HAND



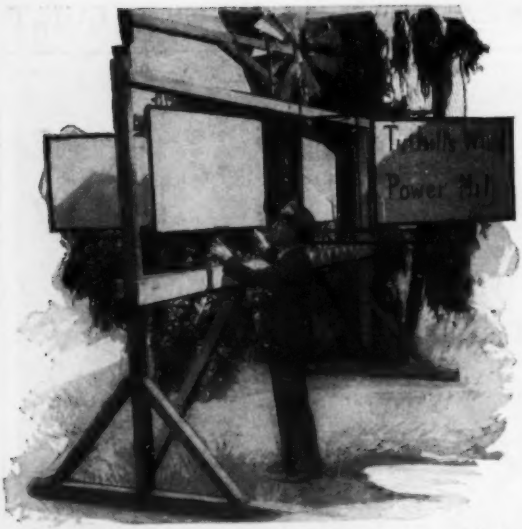
Operated by current from a lighting socket, a sewing machine can be carried with one hand and may be used on a card table or other small area. It weighs less than twelve pounds, including the motor, is simple to use and does practically everything that the larger machines will do. The motor is built into the base of the machine.

¶Scientists believe that ancestors of the whale lived on dry land.

ELECTRIC DRIVE FOR LARGEST VESSEL EVER BUILT

Very light smoke; no Soot or Ash to fall on Passenger Decks
Overflow Tank for Oil expanded from Storage Tanks
X.X Air Ducts cooling Motor and Alternator

Copyright S W. Clatworthy



Model of Special Windmill, to Generate Electric Power; the Wheel Serves as a Governor for the Blades

WINDMILL WITH SIX SAILS TO GENERATE POWER

To generate electric power, a Los Angeles inventor has developed a "lever type" windmill. Besides the old-fashioned wheel, it has six sails which operate somewhat like paddles. They are designed to revolve two-thirds of the way around a circle and "feather back" with the wind to the pulling position. The wheel acts mainly as a governor to keep the paddles from going too fast. The inventor spent his spare time for two years developing the model of his mill.

ELECTRIC "EYE" COUNTS AUTOS USING RIVER TUNNEL

Keeping count of the number of automobiles that pass through the Holland vehicle tunnel in New York is simplified by employing the magic power of the photo-electric cell. As the cars emerge from the tube, each interrupts a beam of light from a spotlight that shines upon the cell. The interruption affects the unit in such a way that it operates an electric counting device which records the number of cars. The "eye" is to be used at several points of the tunnel.

RUBBER FROM OIL SHALE TO CUT COST

A new source of rubber has been developed from the hydrocarbon extracts from oil-bearing shale. These shale deposits are to be found in enormous quantities in the western states, and have been a source of chemical research for a number of years. A. R. Lendner has been successful in producing inorganic rubber from his large shale deposits in California. This material has already undergone many rigid tests, and its elasticity and abrasive resistance have been found to be of the finest, comparing favorably with vegetable rubber. It is possible to produce enormous quantities of this new shale rubber for years to come from deposits already found. Heretofore the oil-bearing shale has been almost valueless, but with the possibility of converting it into rubber, new interest is aroused. This inorganic rubber can be produced, it is said, at a reasonable profit for less than half of the present market price for crude rubber of vegetable origin, and hence the discovery gives promise of being very valuable.

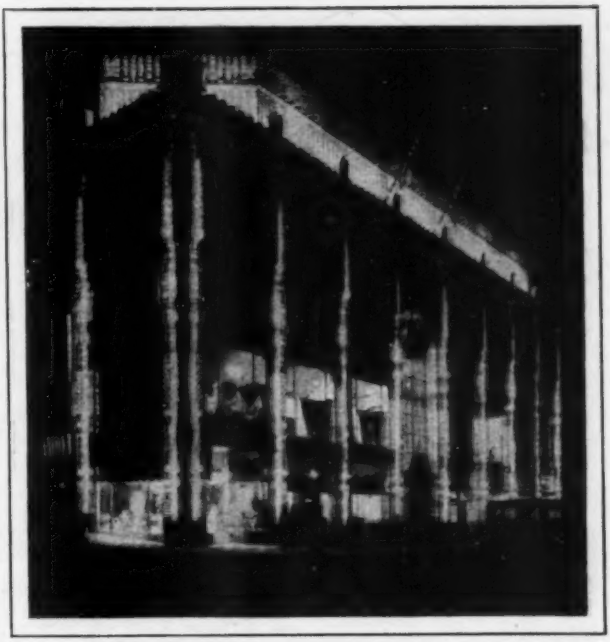
CIGARET LIGHTER IN PENCIL END SAVES EXTRA ARTICLE

One end of a pencil now on the market is a cigaret and cigar lighter, so that an extra article need not be carried in the pocket. The flame is produced when the end cap is pulled off, friction against a piece of flint causing a spark which lights a wick. This eliminates the need of wheels, springs and other parts. The pencil is of the refillable type, leads being loaded from the front and adjusted by a turn of the tip.

HOME-MOVIE FILM ENLARGER NEEDS NO DARKROOM

Enlargements may be made from home-movie films without the use of a darkroom by employing a unit just introduced. It consists of a tapered box, at the small end of which is an enlarging lens, mounted in fixed focus. The lens on the projector is removed and the enlarger slipped on. A shaft on the enlarger automatically focuses the latter. A film-pack adapter, supplied with the enlarger, is loaded with film and slipped into place at the large end of the box. The hinged cover is then raised so that the film may be viewed as it is projected upon the surface of the adapter slide. When a scene from which an enlargement is desired appears upon the screen, the projector clutch is disengaged, the enlarger shutter closed, the pack-adapter slide removed, and the picture is projected just as one would project a single frame upon a screen.

Enlarging Outfit for the Home-Movie Film in Operation; It Can Be Used without a Darkroom



How the John H. McClatchey Building in Philadelphia Appears at Night with Its Special Lighting System

MASTERPIECE IN LIGHTING SEEN IN STORE'S EXTERIOR

Illuminating engineers have pronounced the John H. McClatchey building, in Philadelphia, the most beautifully lighted structure in the United States. It has sixteen terra-cotta-faced columns which are set off by art-glass panels lighted from within, while diffused light, in different colors, bathes the face of the building in many hues. Above the main entrance is a stained-glass window with deep sea-blue, orchid and lavender tones predominating.

BOILING WATER CLEARS STREET AS SUBSTITUTE FOR PLOW

Tank loads of boiling water were used in Seattle to clear away piles of snow and ice, that accumulated during a cold period last winter. Regular street-flushing tanks were employed and were filled at the city light company's steam plant. Columns of the hot water were forced into the snow piles, quickly melting and softening them so that the material ran down the drains.

The Gold Rush

Courtesy Sir Oswald Stoll

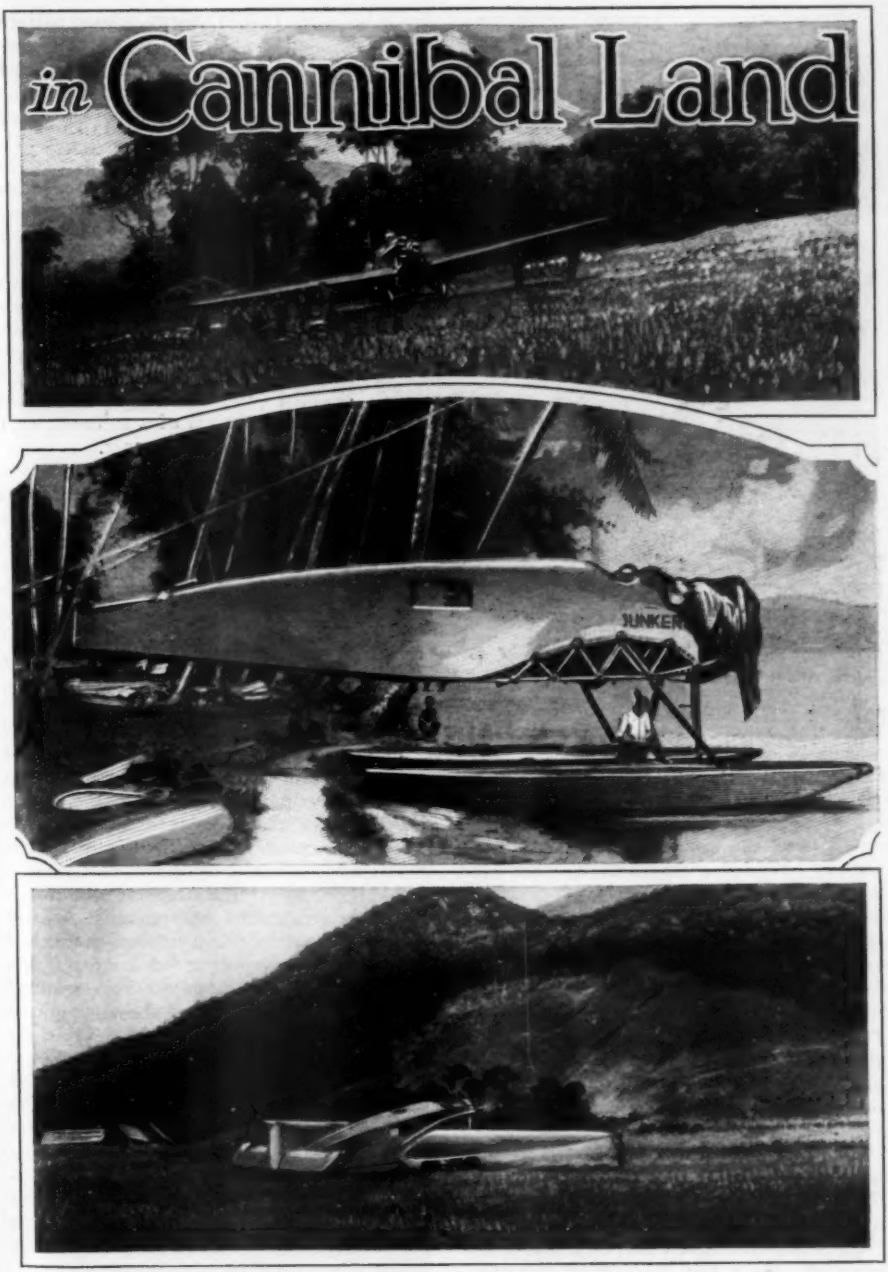
Staging a Cannibal Scene in the Jungle; a Pair of Gold Hunters and Their Native Servant Bound by the New Guinea Savages as a Preliminary to a Cooking-Pot Scene

By HAROLD T. WILKINS

A CREW of Papuans, some of them blood relations of the tribes of cannibals and head-hunters in the gold mountains back of the Razorback range of the far interior of New Guinea, have recently taken on a new job.

When the steamer from Sydney, Australia, carrying the newest thing in airplanes for the New Guinea airways, berths in the palm-fringed coast port of Papua, the natives, uttering fearful shouts, rush down the coral beaches to haul on the ropes of a derrick, one leg of which has a fulcrum in the shape of a coconut palm. The hook of the derrick is hitched in the fuselage of the new Junkers monoplane with Bristol "Jupiter" engines, on the deck of the steamer, and with a real blood-curdling chorus of war cries, the natives strain on the ropes of the derrick.

The airplane rises slowly into the air, and is deposited on the coral beach, where another crew acts as a handling party, pushing the plane into the hangar whence it will be piloted by an ex-British royal air force airman taking gold prospectors over leagues of deadly steaming forests, infested with tree leeches, to the far-away gold fields, and bringing back the bulging pokes of the gold seekers who have "struck lucky." The airplane shortens to hours what, till a few months back, was a very dangerous trip of months through dense woods and mountainous country, peopled



The Latest in Gold Prospecting, a Junkers "Jupiter" on Wheels and Floats: Top, Taking Off for the New Papuan Fields; Center, on a Palm-Fringed Lake; Bottom, the New Guinea Airport

Courtesy Sir Oswald Stoll

Gold Diggers Washing River Sand on a Creek Bank in the Razorback Range of Interior New Guinea

by warlike head-hunters of ferocious fame.

Much of the gold is washed down the watershed parting Papua from what used to be German New Guinea. Years ago, British prospectors knew of the existence of the gold, but the Germans lost the territory before they could find the deposits. Gold worth $5,000 was recently found in one day in the sands of a river on the "mandate" side of the mountain range of central Papua. But when, some months ago, a party of five Australian gold prospectors were eating dinner in a lonely valley of the range, hundreds of fierce Papuan warriors fired clouds of arrows out of ambush and killed three of the men. The survivors managed to reach a white outpost, after dreadful sufferings, when the government sent a punitive expedition to track down the murdering Papuans. The expedition advanced along a narrow path by a steep precipice, against a hostile village, whose natives swarmed out armed, until the party advanced farther, firing over the natives' heads to cover the movement. The village was taken, and in four days six other deserted villages were occupied. The expedition had orders only to fire in self-defense and not to use machine guns. Then the natives turned out in hundreds, and the government expedition had to beat a retreat until the arrival of a steamer with reinforcements.

The natives have a system of taboos, or forbidden things, and it is the infringement of these taboos by white prospectors which leads to massacres. Though the tribes are cannibals, they are said to be particular about the men they eat.

"The victim at our cannibal feasts is a guest of honor. He is delighted to come. We pay him high tribute," so said the New Guinea cannibals to a London university professor exploring the unknown hinterland, in the summer of 1928.

The coming of the airplane will revolutionize conditions of transport to and from the gold fields. Without the aid of aircraft, the prospector has to grope his way through the woods wherein tropical rains drip incessantly, and the atmosphere is humid and fever-laden at a nearly perpetual temperature of 100 degrees Fahrenheit in the shade. Leeches of abnormal size and ferocity hang on the branches of the trees and fasten themselves on the perspiring skins of living things until they drop off gorged with blood. Stores cannot be floated down rivers, but have to be carried on the shoulders of human beings over a range of wild mountains, sometimes 12,000 feet in height.

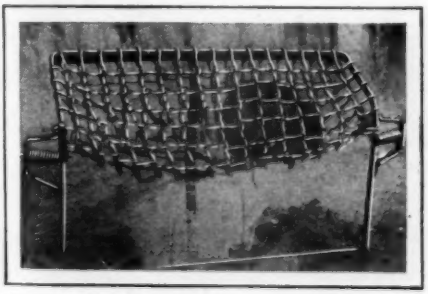
The nearest port to the new gold fields is the ex-German radio station at Mo-

robe, which is fifty miles distant, while Rabaul, the one-time German capital of Papua, is nearly 100 miles from the gold fields, with a range of practically unknown and unexplored mountains in between the sands of the gold-bearing rivers and the nearest outpost of civilization.

The digger has a difficult problem to solve, if he carries away his load himself on foot. Coast natives are afraid of the upcountry natives, who are cannibals and head-hunters, while bushrangers of the type who infested the Australian gold fields of the 1840's, lie in wait nearer the coast to shoot and plunder the unsuspecting digger. The gold is not of the richest quality, since it is found with quartz. It is worth around $3 an ounce, and no white man can carry a great load through pathless forests and over inhospitable ranges. Here is just where the Junkers monoplane, with its Jupiter Bristol engines, laughs at the thieves and head-hunters lying in wait in the ranges or ambushed in the depths of the leech-infested forests.

TRAP CATCHES ANIMALS ALIVE IN WIRE BAG

For catching animals alive, a humane and efficient trap now on the market, has spring jaws to which is connected a net bag made of chain wire. It is also fitted with a lifting device which raises the trap as much as fifteen inches after it has been sprung. This is an advantage in catching mink, muskrats and similar animals, as they are automatically lifted out of the water after capture. The jaws of the trap fly up over the animal, drawing the net bag around it and, at the same time, the lifting device is released.



Trapped Alive and without Injury; the Wire-Net Snare Sprung and Ready for Opening

Sign at Detroit Street Crossing, Warning Pedestrians That It Is Too Late to Cross Before Lights Change

TOO-LATE SIGN FOR PEDESTRIAN HELPS REDUCE ACCIDENTS

To protect pedestrians by reducing the chances of their being caught in the center of a street intersection when the traffic-control lights change from green to red, a series of electrically operated warning signs have been installed by the Detroit police department on a busy downtown corner. The markers are so arranged that a pedestrian faces one of them, no matter in which direction he may be walking on any of the four crosswalks at the intersection. The signs are about two feet in diameter, drum-shaped and are suspended on brackets attached to the signal-light poles. At a carefully determined interval, the warning, "Pedestrians Stop, Too Late to Start," is flashed so that the person on foot will remain on the sidewalk instead of attempting to cross.

¶Those wishing further information on anything described in the editorial pages can obtain it by addressing Bureau of Information, Popular Mechanics Magazine.

Testing a Sample of the New Brick, Which Is Light and Strong and Holds Nails Firmly

SEE HUNDRED-STORY BUILDINGS AS RESULT OF NEW BRICK

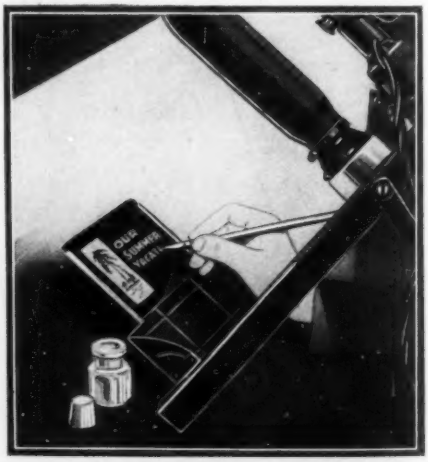
One-hundred-story skyscrapers will be as common in the city of the future as the twenty-story building is today, according to Dr. George A. Bole, of Ohio State University. His prophecy is based partly on the development of a new kind of brick. It weighs only one-sixth as much as the usual varieties, but is said to have greater strength and fire-resisting qualities. Ordinary brick weighs 120 pounds to the cubic foot. The improved form weighs but twenty. The new tile will defy a temperature of 3,250 degrees for fifteen hours, according to reports. Because of its lightness and strength, this material will permit higher buildings with more pyramiding, thinner walls and therefore less bulk so that space will be saved for practical uses.

TREE IMMUNE TO DISEASE YIELDS EDIBLE NUT

So far as can be learned, the Japanese ginkgo tree is the only species of plant life growing in this country today that does not have some sort of an enemy, an insect, fungus or other pest trying to take its life, according to Dr. William A. Taylor, of the bureau of plant industry. A driveway leading to the department of agriculture buildings is lined on both sides with these trees. In the fall, their leaves turn a brilliant yellow of striking appearance. The ginkgo produces a nut which the oriental people relish but which is abominable to the white man, the chief reason being that, although the kernel is of a pleasant taste, it is surrounded by a pulp of a disagreeable odor.

HOME-MOVIE TITLE WRITER HELPS IMPROVE FILMS

Preparation of titles, special diagrams and other inserts for the motion-picture film taken at home, is made simple with a compact outfit recently introduced. It consists of a mount for the camera, a card holder, two specially designed electric lights, operated by current from a house socket, and an automatic focusing prism. The title is written in white ink on a black card which remains in its holder in correct position for photographing. If desired, the camera may be operated while the writing is in progress, showing the hand in motion. The outfit may be used for making movie cartoons, for taking reproductions of miniature scenes and special backgrounds, and for other "trick" shots that add variety and interest to the finished reel.



Drawing of the Title Writer for Amateur Motion-Picture Photographer; Note Special Lights at Sides

SAFER FLYING CUTS INSURANCE COSTS

Reductions of as much as forty per cent on premiums of aviation-insurance policies have been ordered since 1922 as a result of the constantly improving safety factor in flying, according to a copyrighted dispatch in the Daily News of New York. Many companies are omitting the clauses in life-insurance policies that make the policy void in case of an aviation accident, and are substituting specific provisions that cover such accidents. According to an official of a company specializing in this kind of insurance, the amount of aviation insurance written has increased more than 400 per cent during the last year. Men experienced in aviation, many of them pilots or ex-pilots, are handling the business for the companies. The American Air Transport association recently announced that passenger lines in the United States are operating on forty-two daily schedules which require more than 33,000 miles of flying every twenty-four hours with stops at 102 cities. At the time this statement was made, eight new lines were scheduled to start, adding about 8,000 flying miles to the daily total.

Swinging Steel Tugboat into the River with Huge Crane; the Method Saved the Building of Ways

STEEL TUG LAUNCHED BY CRANE FOR RIVER SERVICE

Instead of constructing ways for launching a steel tug, the craft was picked up by a huge crane and swung from the yard into the Willamette river, at Portland, Oreg. The boat is equipped with 250-horsepower motors and is sixty-five feet long over all.

AUTO JACK CRANKED AT SIDE SIMPLIFIES RAISING CAR

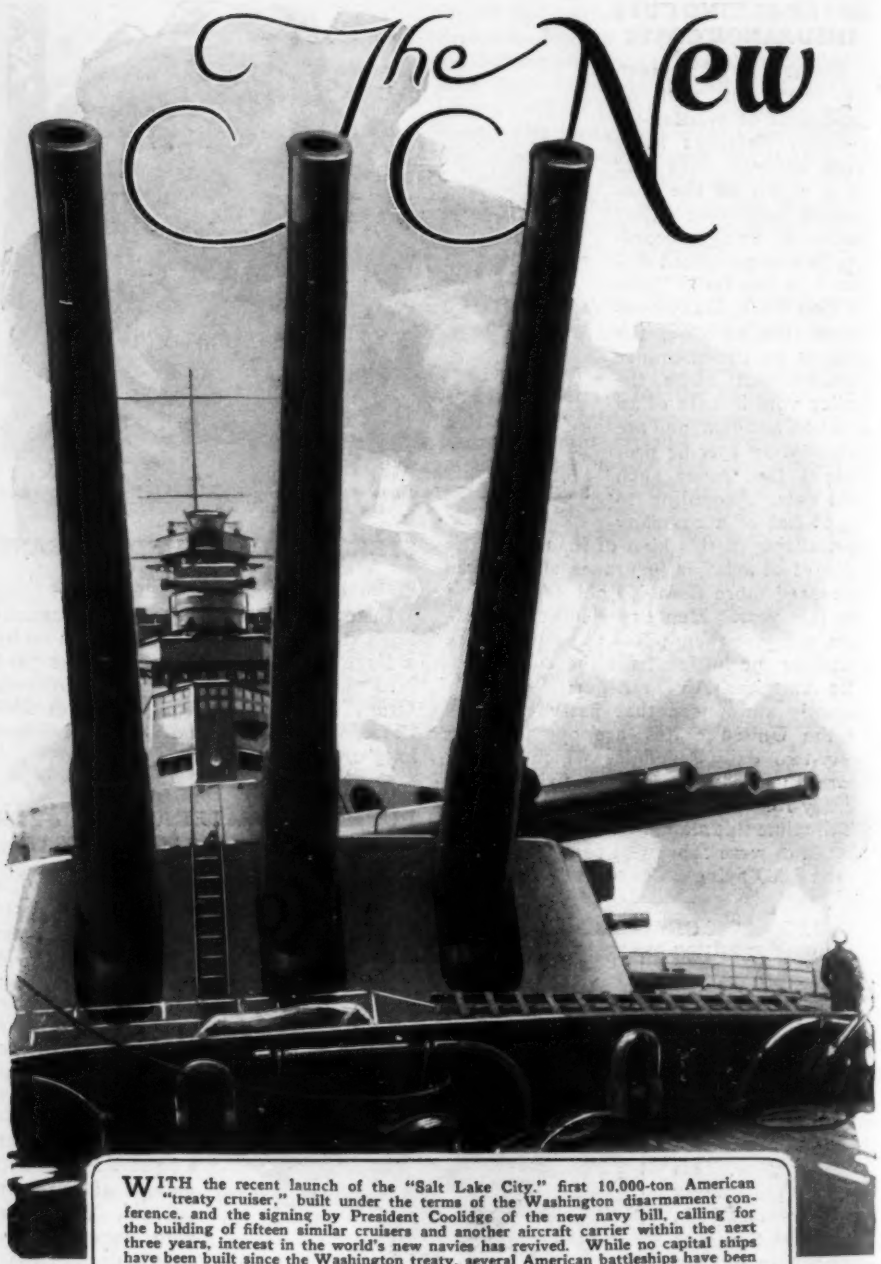
By turning a crank at the side of the running board, the automobile is quickly and easily raised at the front or rear or at both ends together. This is made possible by a three-unit jack, one under the front axle and two at the rear. The jack fits any make of car.

Jacking Up the Car by Turning Crank at Side of Running Board; Front and Rear Are Raised

PURIFYING WATER WITH SILVER REDUCES TREATMENT COSTS

By introducing a small quantity of a specially prepared silver compound, a German chemist is reported to have developed a method for purifying large amounts of water at a relatively low cost. He simply injects the compound into the water, one and one-half grams of the chemical being sufficient to disinfect about 2,500,000,000 gallons of water, it is said. Scientists who have investigated, declare that the effects also are lasting.

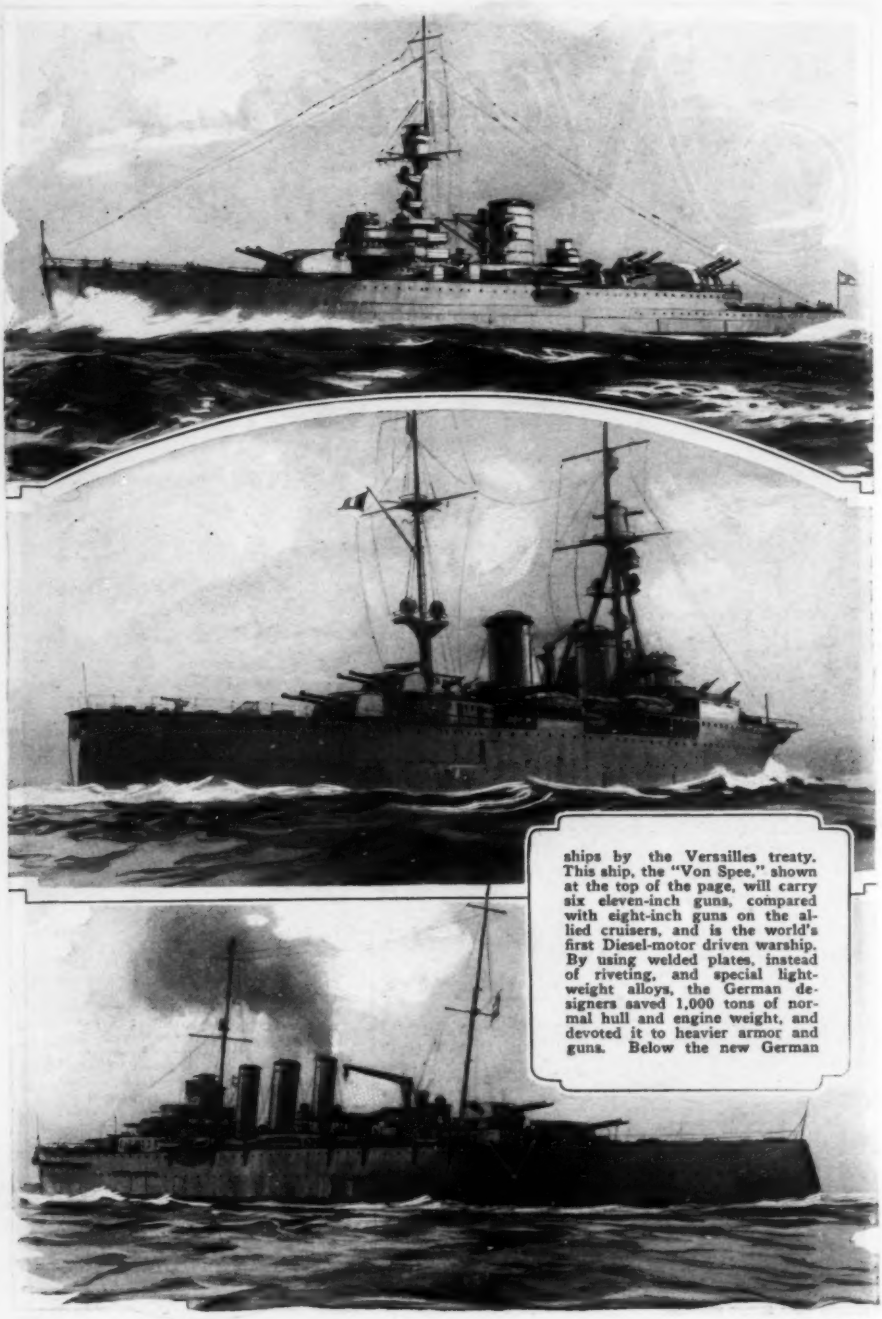
The New



WITH the recent launch of the "Salt Lake City," first 10,000-ton American "treaty cruiser," built under the terms of the Washington disarmament conference, and the signing by President Coolidge of the new navy bill, calling for the building of fifteen similar cruisers and another aircraft carrier within the next three years, interest in the world's new navies has revived. While no capital ships have been built since the Washington treaty, several American battleships have been remodeled and their guns changed to equal the high-angle fire of the British big

Navies

ships, such as the guns of the "Rodney," on the opposite page. One of the important changes made in the American ships has been the replacement of basket-type masts with tripods, carrying extensive fire-control and searchlight platforms. The alteration in appearance is shown in the photo of the battleship "Texas," above, taken as she approached the Brooklyn bridge. Other changes include more deck armor to resist aerial bombs, bigger and better anti-aircraft batteries, and underwater protection against torpedoes. While the allies in the late war have been concentrating on treaty cruisers, the Germans stole a march by producing a new type of battleship, within the 10,000-ton limit set on German



ships by the Versailles treaty. This ship, the "Von Spee," shown at the top of the page, will carry six eleven-inch guns, compared with eight-inch guns on the allied cruisers, and is the world's first Diesel-motor driven warship. By using welded plates, instead of riveting, and special lightweight alloys, the German designers saved 1,000 tons of normal hull and engine weight, and devoted it to heavier armor and guns. Below the new German

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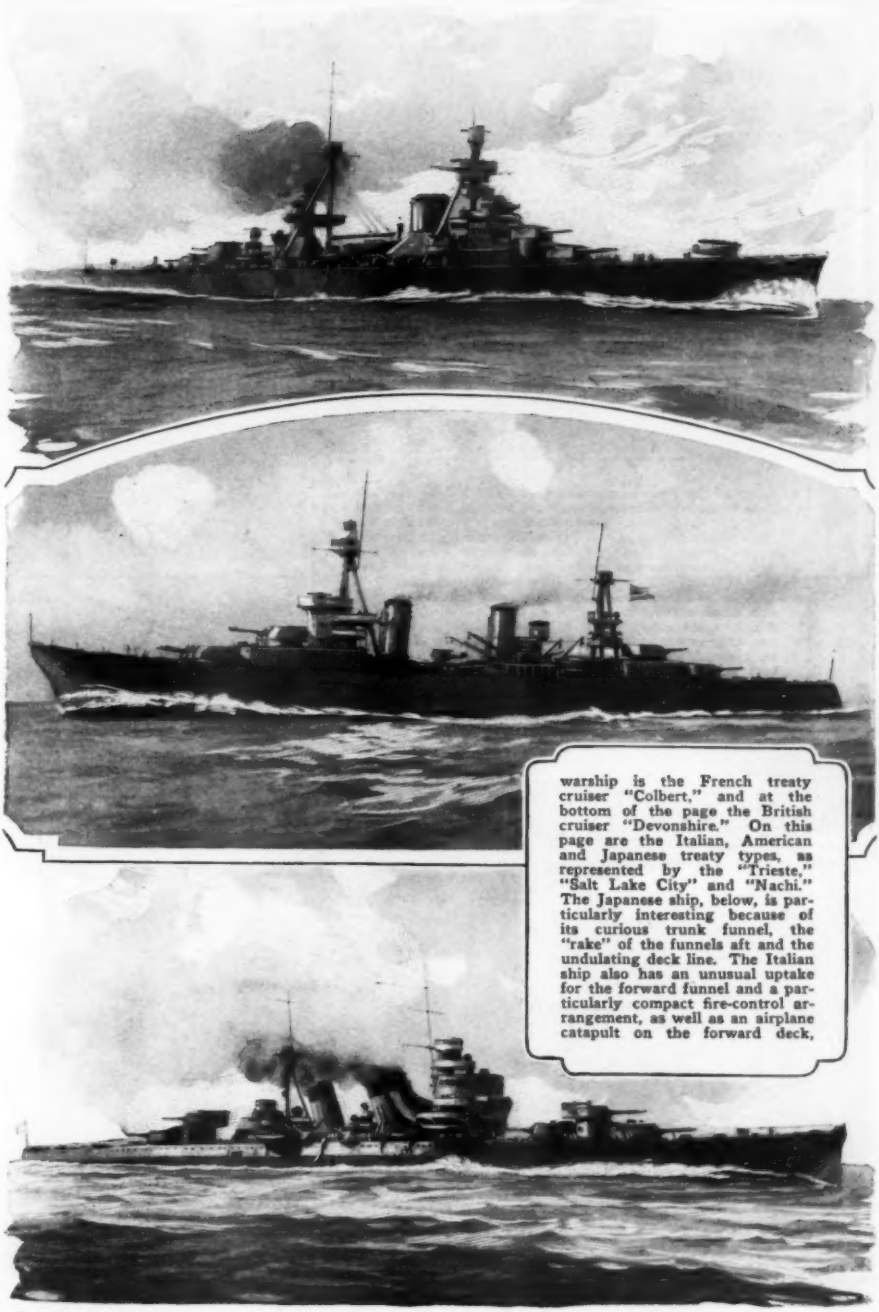
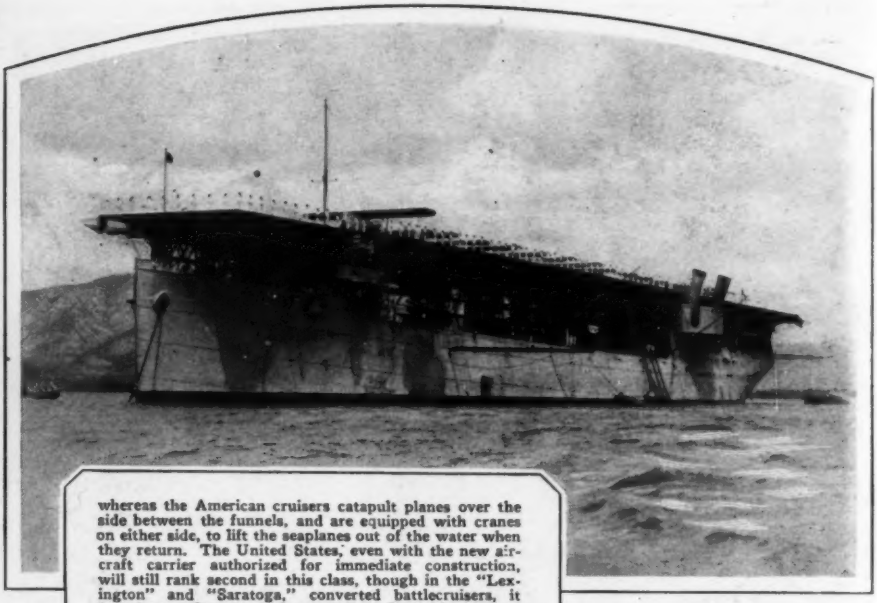
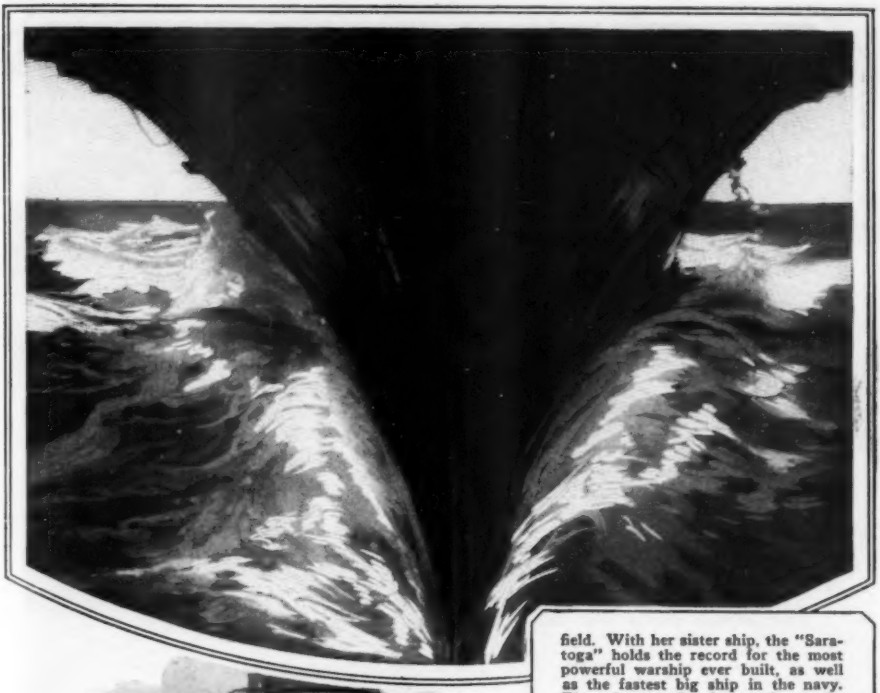


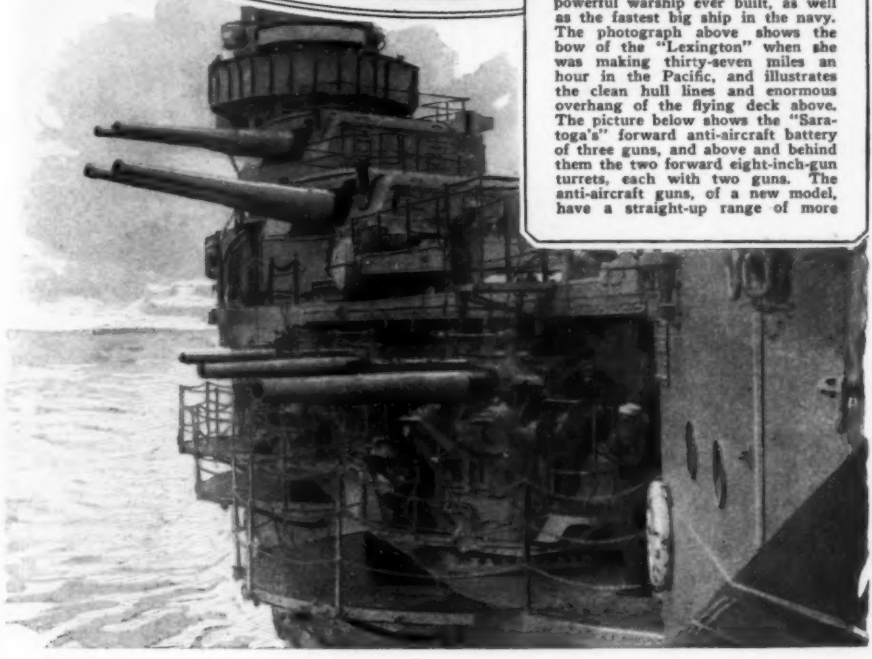
warship is the French treaty cruiser "Colbert," and at the bottom of the page the British cruiser "Devonshire." On this page are the Italian, American and Japanese treaty types, as represented by the "Trieste," "Salt Lake City" and "Nachi." The Japanese ship, below, is particularly interesting because of its curious trunk funnel, the "rake" of the funnels aft and the undulating deck line. The Italian ship also has an unusual uptake for the forward funnel and a particularly compact fire-control arrangement, as well as an airplane catapult on the forward deck,

© Dr. Oscar Parkes

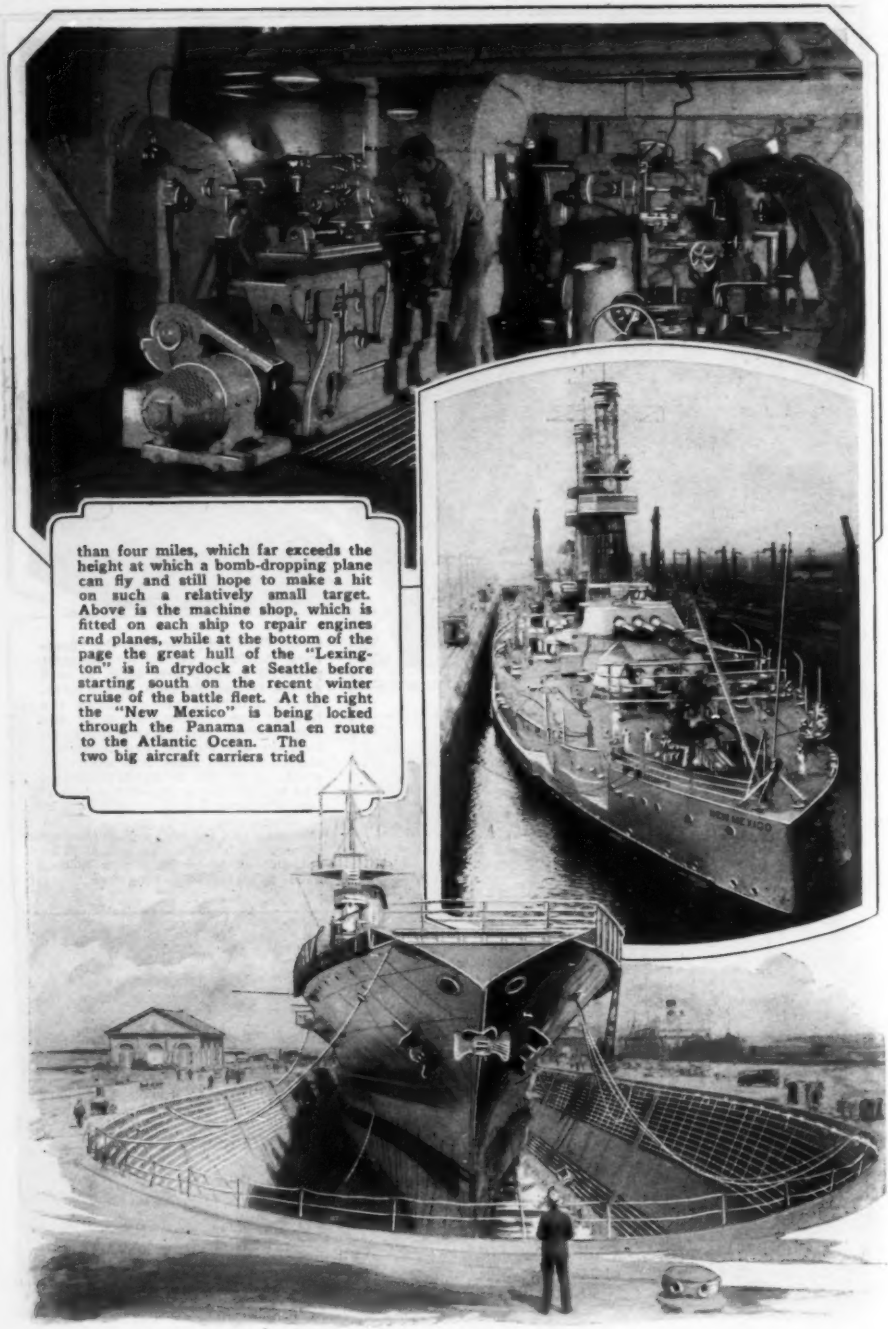


whereas the American cruisers catapult planes over the side between the funnels, and are equipped with cranes on either side, to lift the seaplanes out of the water when they return. The United States, even with the new aircraft carrier authorized for immediate construction, will still rank second in this class, though in the "Lexington" and "Saratoga," converted battlecruisers, it has the two largest airplane carriers afloat. At present, one other carrier is in service, the "Langley," above, which was converted from a collier. Some idea of the spaciousness of an aircraft carrier's flying deck can be gleaned from the picture below, showing the football team of the "Saratoga" practicing on the flying

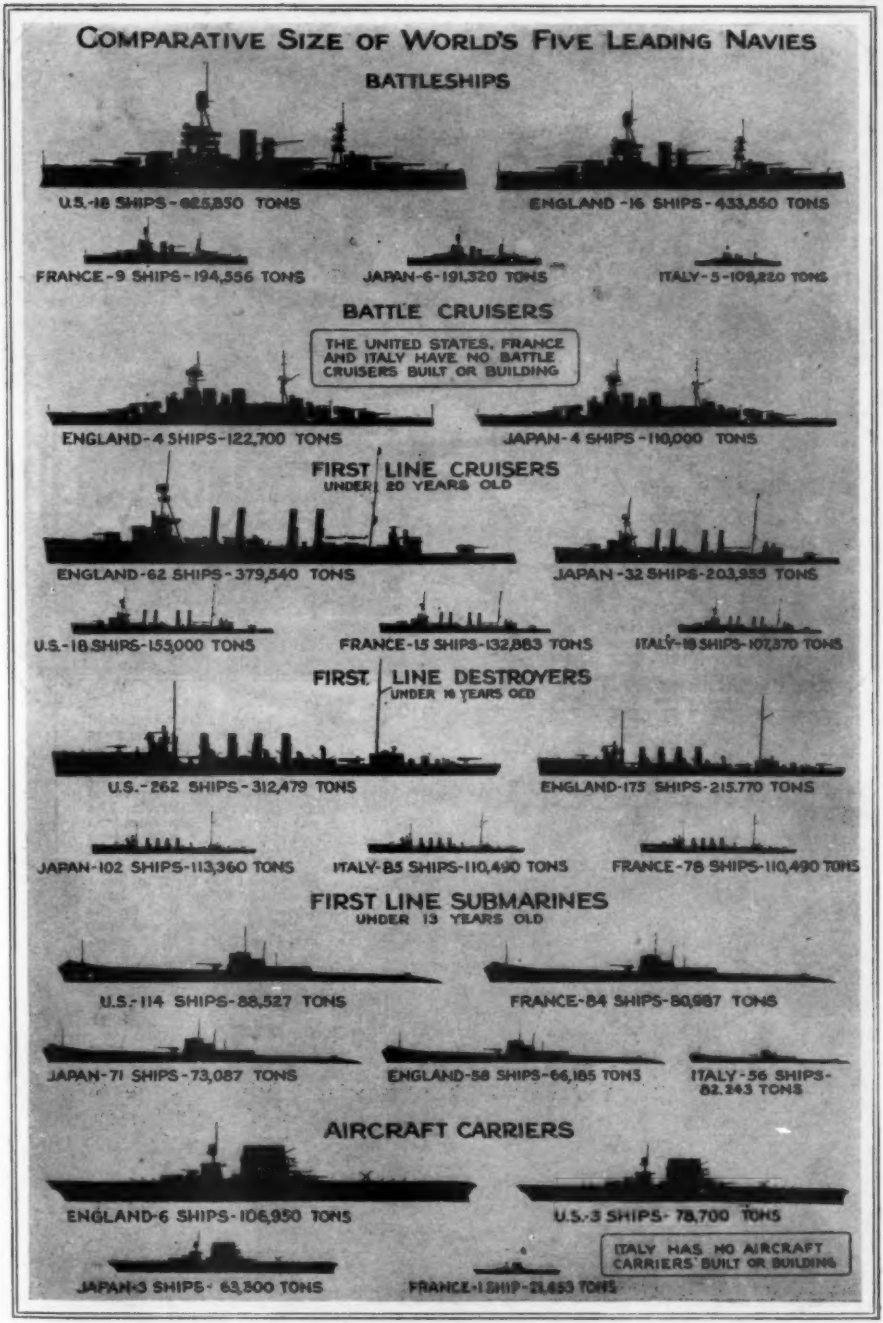




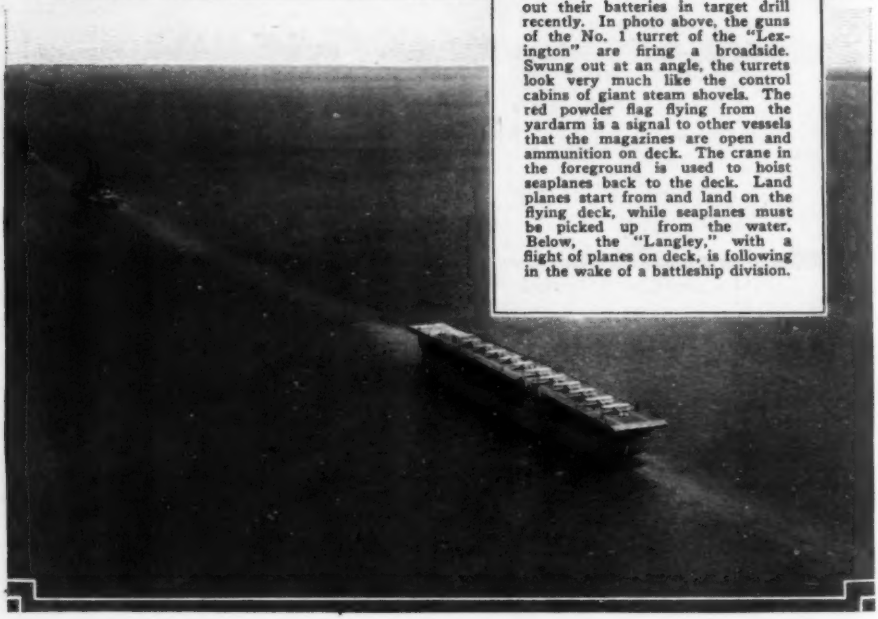
field. With her sister ship, the "Saratoga" holds the record for the most powerful warship ever built, as well as the fastest big ship in the navy. The photograph above shows the bow of the "Lexington" when she was making thirty-seven miles an hour in the Pacific, and illustrates the clean hull lines and enormous overhang of the flying deck above. The picture below shows the "Saratoga's" forward anti-aircraft battery of three guns, and above and behind them the two forward eight-inch-gun turrets, each with two guns. The anti-aircraft guns, of a new model, have a straight-up range of more



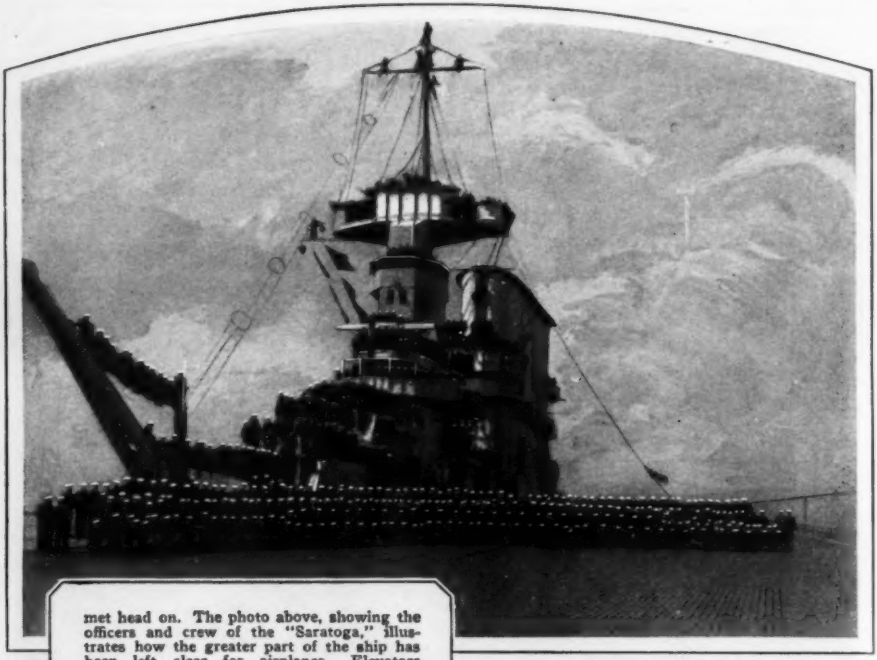
than four miles, which far exceeds the height at which a bomb-dropping plane can fly and still hope to make a hit on such a relatively small target. Above is the machine shop, which is fitted on each ship to repair engines and planes, while at the bottom of the page the great hull of the "Lexington" is in drydock at Seattle before starting south on the recent winter cruise of the battle fleet. At the right the "New Mexico" is being locked through the Panama canal en route to the Atlantic Ocean. The two big aircraft carriers tried


COMPARATIVE SIZE OF WORLD'S FIVE LEADING NAVIES
BATTLESHIPS
U.S.-18 SHIPS-625,850 TONS
ENGLAND-16 SHIPS-433,850 TONS
FRANCE-9 SHIPS-194,556 TONS
JAPAN-6-191,320 TONS
ITALY-5-109,220 TONS
BATTLE CRUISERS
THE UNITED STATES, FRANCE AND ITALY HAVE NO BATTLE CRUISERS BUILT OR BUILDING
ENGLAND-4 SHIPS-122,700 TONS
JAPAN-4 SHIPS-110,000 TONS
FIRST LINE CRUISERS
UNDER 20 YEARS OLD
ENGLAND-62 SHIPS-379,540 TONS
JAPAN-32 SHIPS-203,955 TONS
U.S.-18 SHIPS-155,000 TONS
FRANCE-15 SHIPS-132,883 TONS
ITALY-19 SHIPS-107,370 TONS
FIRST LINE DESTROYERS
UNDER 16 YEARS OLD
U.S.-262 SHIPS-312,479 TONS
ENGLAND-175 SHIPS-215,770 TONS
JAPAN-102 SHIPS-113,360 TONS
ITALY-85 SHIPS-110,490 TONS
FRANCE-78 SHIPS-110,490 TONS
FIRST LINE SUBMARINES
UNDER 13 YEARS OLD
U.S.-114 SHIPS-88,527 TONS
FRANCE-84 SHIPS-80,987 TONS
JAPAN-71 SHIPS-73,087 TONS
ENGLAND-58 SHIPS-66,185 TONS
ITALY-56 SHIPS-62,243 TONS
AIRCRAFT CARRIERS
ENGLAND-6 SHIPS-106,950 TONS
U.S.-3 SHIPS-78,700 TONS
ITALY HAS NO AIRCRAFT CARRIERS BUILT OR BUILDING
JAPAN-3 SHIPS-63,300 TONS
FRANCE-1 SHIP-21,833 TONS

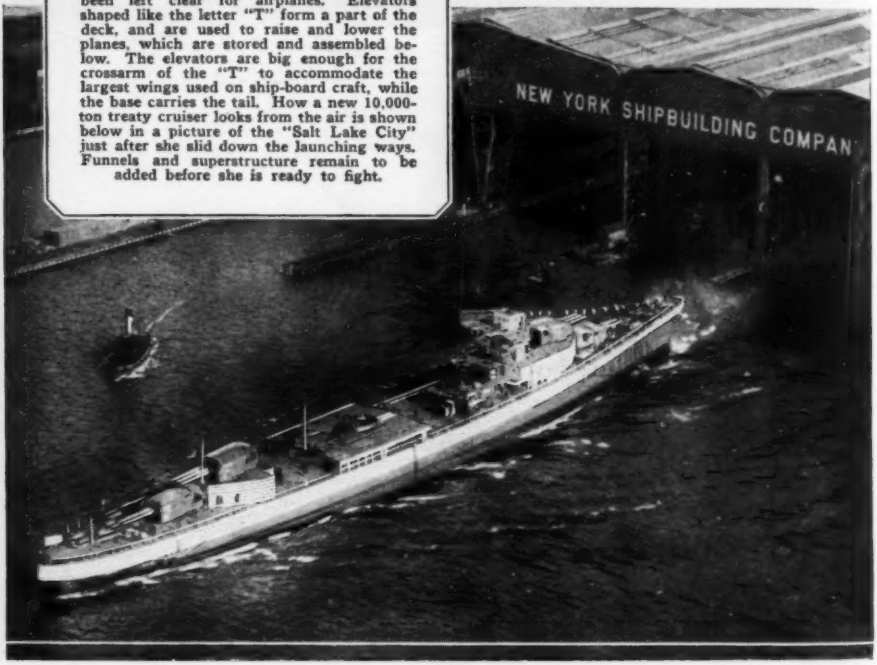
out their batteries in target drill recently. In photo above, the guns of the No. 1 turret of the "Lexington" are firing a broadside. Swung out at an angle, the turrets look very much like the control cabins of giant steam shovels. The red powder flag flying from the yardarm is a signal to other vessels that the magazines are open and ammunition on deck. The crane in the foreground is used to hoist seaplanes back to the deck. Land planes start from and land on the flying deck, while seaplanes must be picked up from the water. Below, the "Langley," with a flight of planes on deck, is following in the wake of a battleship division.



The picture above shows the "Saratoga" during her full-power trials, and at the right is England's most powerful submarine, a giant cruiser equipped with two long-range guns in an armorplated turret, making her as effective as a monitor in a surface battle. Below, the sailors of the "Lexington" are hooking their hammocks to hoisting ropes to be given a drying and airing. To leave a clear flying deck, the funnels, turrets, bridge and fire-control platforms of the aircraft carriers are all concentrated on one side of the ship, giving a curiously lopsided appearance when one of the ships is



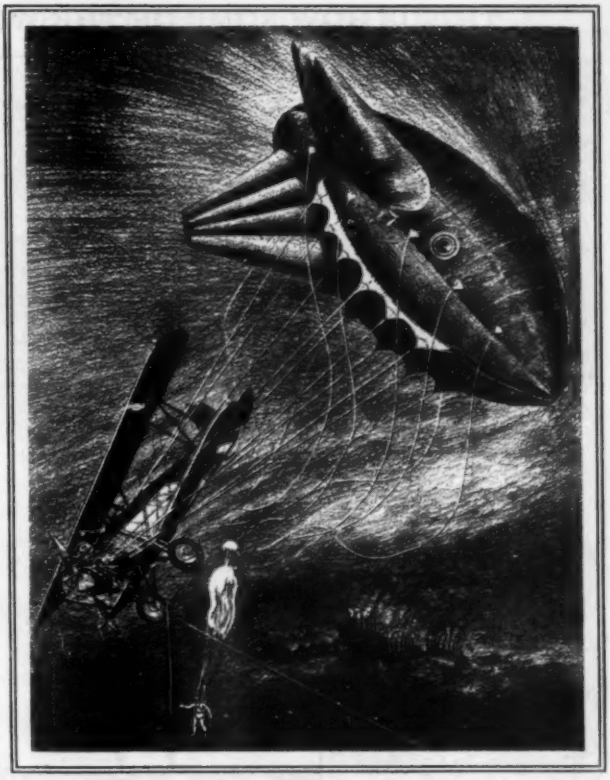
met head on. The photo above, showing the officers and crew of the "Saratoga," illustrates how the greater part of the ship has been left clear for airplanes. Elevators shaped like the letter "T" form a part of the deck, and are used to raise and lower the planes, which are stored and assembled below. The elevators are big enough for the crossarm of the "T" to accommodate the largest wings used on ship-board craft, while the base carries the tail. How a new 10,000-ton treaty cruiser looks from the air is shown below in a picture of the "Salt Lake City" just after she slid down the launching ways. Funnels and superstructure remain to be added before she is ready to fight.



© Aero Service Corp.

STOPPING WASTE OF SOIL EROSION IS URGENT NEED

More extensive and more effective measures to prevent erosion of the soil by rivers are urgently needed, department of agriculture investigators report, to reduce the annual destruction to fertile farms and valleys. More than 513,000,000 tons of soil are being washed out to the seas every year, they declare. The Mississippi river system alone is responsible for some 428,000,000 tons of this loss. Terracing fields, contour plowing and cultivating, wise forestry management and the further conservation of forests, are partial remedies, and the most complete co-operation on the part of farmers and engineers is all-important. It is estimated that with the soil washed away goes not less than 126,000,000,000 pounds of plant food, about twenty-one times the quantity that is naturally taken out of the fields by the annual crops harvested. If purchased at market prices, the phosphorus, potassium and nitrogen lost would cost over $2,000,000,000.



Drawing to Show the Operation of the Airplane Trap, a Captive Balloon Draped with Piano Wires as a Snare

INVISIBLE WALLS HUNG IN SKY TO FOIL AIRPLANES

Captive balloons, bearing nets of piano wire that hang down as invisible barriers for night-traveling airplanes, have been proposed as a means of curbing bomb attacks under darkness. Afloat at an altitude of 1,000 feet or so, a number of these trap-bearing balloons would form a serious obstacle to the bombing planes, which must fly comparatively low and are operated chiefly on very dark nights when they are not so likely to be seen. Big fins, holding gas, keep the balloons afloat, and what appears to be a huge eye in each bag, is the valve for the gas.

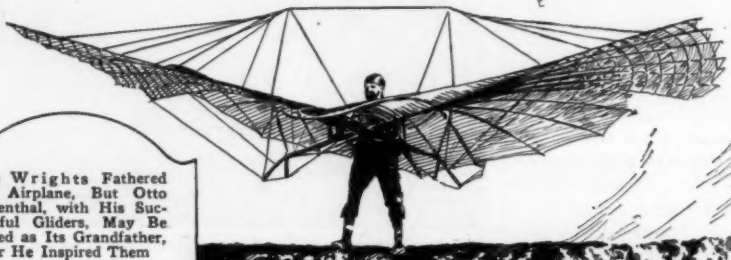
RUNNING-BOARD FOOT SCRAPER HELPS KEEP AUTO CLEAN

To remove mud and dirt from the shoes before entering the car, a scraper adjusted to the running board and pushed underneath when it is not in use, has been introduced. It can be attached quickly, and is securely anchored so that it will not rattle.

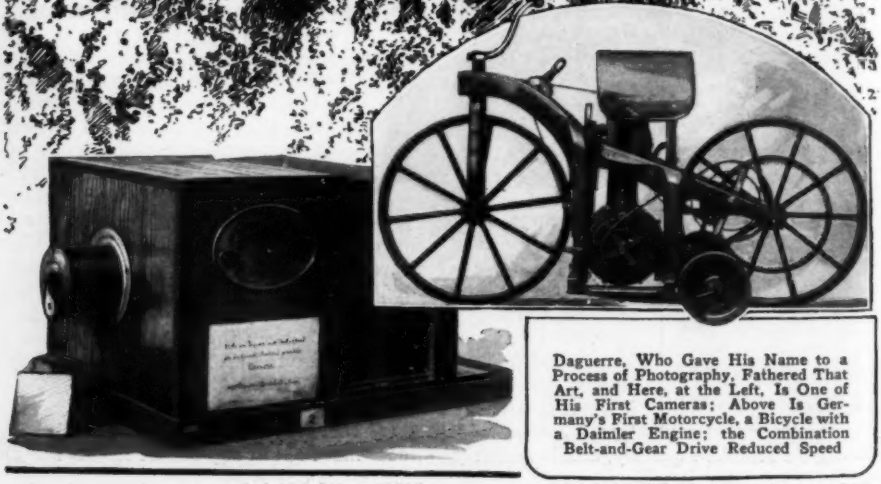
¶Whenever you find that you wish to know more about any article in this magazine, write our Bureau of Information.

THIS IS HOW SOME OF THE WORLD'S FAMILIAR

Here Is the World's First Electric Street Car, Built by Werner von Siemens at Gross-Lichterfelde, Germany, in the Year 1881

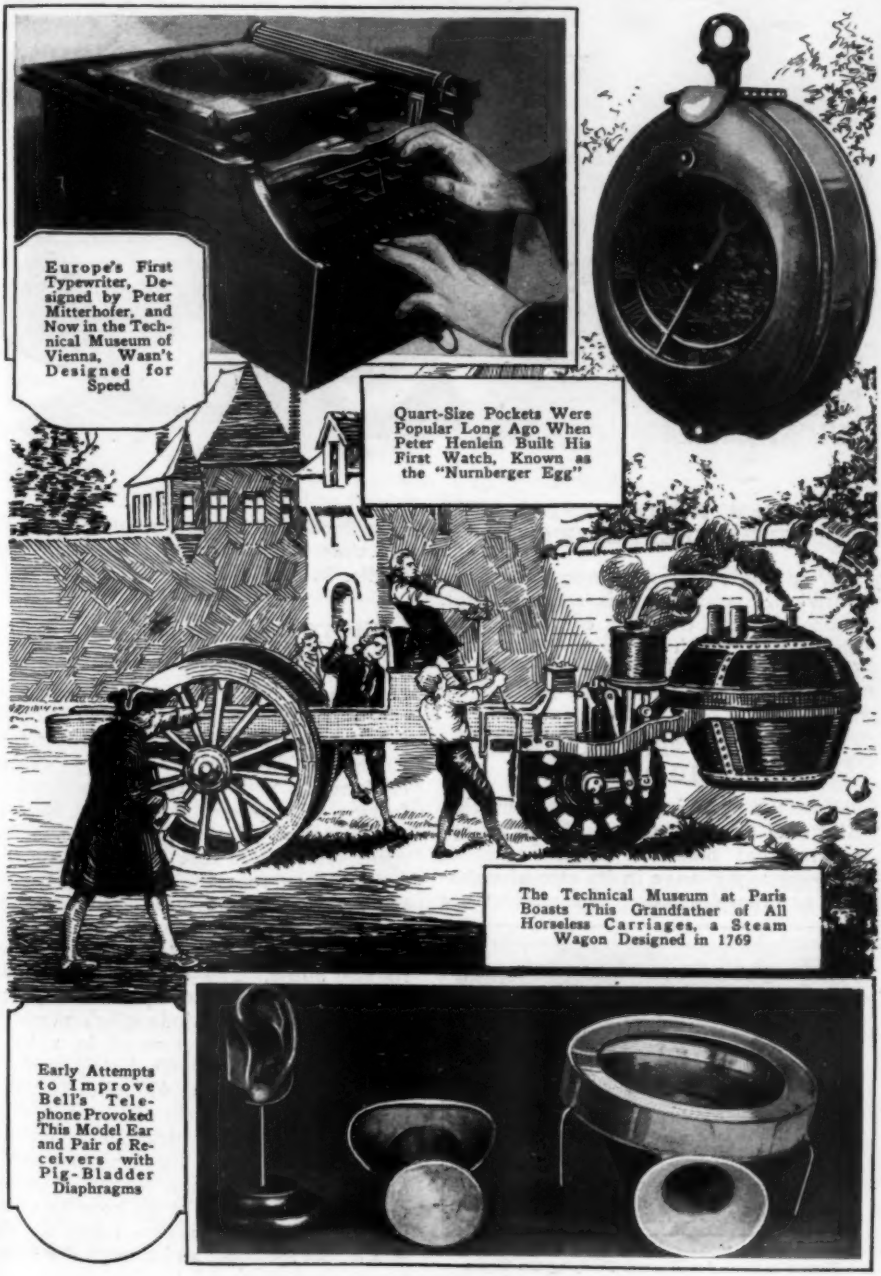


The Wrights Fathered the Airplane, But Otto Lilienthal, with His Successful Gliders, May Be Rated as Its Grandfather, for He Inspired Them



Daguerre, Who Gave His Name to a Process of Photography, Fathered That Art, and Here, at the Left, Is One of His First Cameras; Above Is Germany's First Motorcycle, a Bicycle with a Daimler Engine; the Combination Belt-and-Gear Drive Reduced Speed

INVENTIONS LOOKED AT THE TIME OF BIRTH

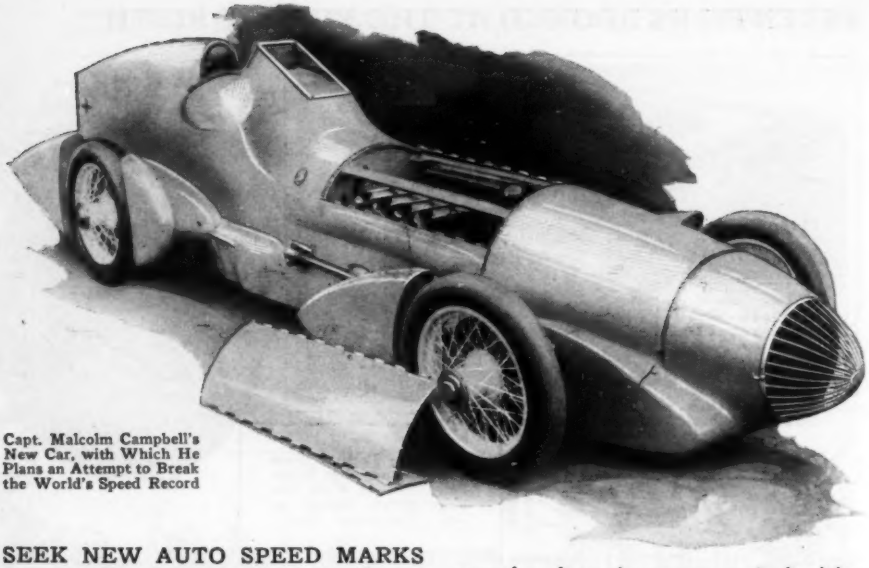


Europe's First Typewriter, Designed by Peter Mitterhofer, and Now in the Technical Museum of Vienna, Wasn't Designed for Speed

Quart-Size Pockets Were Popular Long Ago When Peter Henlein Built His First Watch, Known as the "Nurnberger Egg"

The Technical Museum at Paris Boasts This Grandfather of All Horseless Carriages, a Steam Wagon Designed in 1769

Early Attempts to Improve Bell's Telephone Provoked This Model Ear and Pair of Receivers with Pig-Bladder Diaphragms



Capt. Malcolm Campbell's New Car, with Which He Plans an Attempt to Break the World's Speed Record

SEEK NEW AUTO SPEED MARKS WITH STREAMLINE CAR

What engineers pronounce as the "last word" in streamlining is seen in Capt. Malcolm Campbell's new car, the "Bluebird," with which he hopes to achieve faster speed marks in tests in South Africa. The car was finished recently in England.

MOVIES OF BEATING HEARTS TO AID DOCTORS

Now the heart itself enters the movies. Electrical experts have developed an apparatus that films the organ in action, showing any change in its rate of pulsation or other features. The pictures are reproduced on the screen, and physicians are thus able to make more thorough studies in case of disease.

Machine Which Films the Beating of a Heart for the Movies as an Aid to Doctors Studying the Organ

PHOTO OF FLAME IS SNAPPED BY HIGH-SPEED CAMERA

A camera, costing $2,500 and taking accurate photos of a flame traveling at 21,000 miles an hour, recently has been tested in England. The camera, which works in conjunction with a dynamo and transformer, with an output of 20,000 volts, is the invention of R. A. Fraser, who has spent seven years investigating the problem of "flame rate," or the speed of an explosive flame. It has been used to photograph the explosion of enough nitroglycerine and dynamite to wreck a ten-roomed house. The photographer and an assistant were separated by five walls, each with an observation window, behind which the explosive was detonated in a large steel cylinder. An endless strip of film, traveling on a drum, at 400 miles an hour, is whirled past a system of lenses, and so well balanced is the drum, that having been once rotated at its maximum speed of 18,000 revolutions a second, it takes more than a quarter of an hour to come to rest. Photographs are taken at the rate of 200 a second, and though the flame

of the explosion travels at from four inches to two miles a second, it appears stationary in the pictures. The experimenters hope to gain data which will help to prevent the present waste of about two-thirds of the power inside the cylinders of gasoline engines.

VAST SALT LAKE IS PLANNED TO WATER THE SAHARA

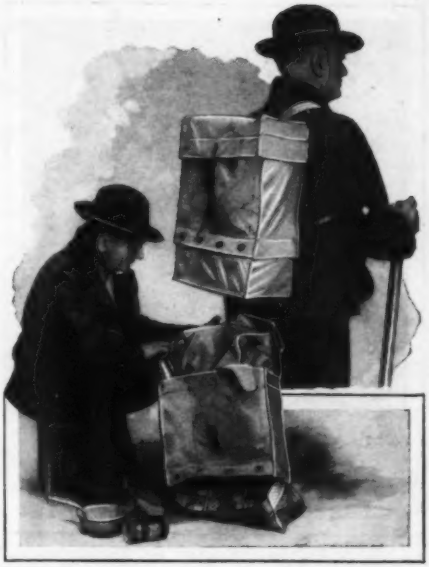
Creation of a vast lake of salt water to change the climate of the Sahara desert and convert a sandy waste into a productive plain has been proposed to the French government by Dwight Braman, of New York, with plans designed by John F. Stevens, who was engineer of the Panama canal. The idea is to dig a canal from the Mediterranean, connecting a series of small lakes which dry up every summer, and admit enough salt water from the sea to keep the lakes filled the year around. An area, 265 miles wide, would be flooded. The presence of so big a body of water would modify the climate to such an extent, it is claimed, that 210,000 square miles could be reclaimed for farming.

SNAP-SPRING CYCLE CARRIER ELIMINATES STRAPS

Bundles are held in a bicycle luggage carrier by means of snap springs instead of with straps. This saves considerable time in loading and unloading, and also guards against loss, it is claimed.

POSTAL MADE FROM FIR TREE

A postcard, eight feet long and four feet high, carrying $16 worth of stamps, recently was delivered to President Hoover, bearing greetings from the Hoover-Curtis club of Washington University, at Seattle. The giant card was in reality a thin board, cut from a Washington fir tree. More than 2,000 members of the club signed the message.



Hunter's Knapsack with Space for Ammunition, Food, Clothing, and a Design Built to Fit the Back

KNAPSACK FOR HUNTERS HOLDS AMMUNITION AND FOOD

Designed especially for duck hunters, but equally serviceable to hikers, trappers and campers, a waterproof knapsack now on the market has four compartments and is shaped to fit the back with comfort. The lower section holds six boxes of shotgun shells, while the upper divisions may be used for food, clothing and other articles. A cover keeps out rain.

VACUUM CUP FASTENS WATCH ON AUTO DASH

Attached to the automobile dash in a few seconds without boring holes, a watch held by a vacuum rubber cup is quickly squeezed into place. Besides keeping the timepiece where it can easily be seen, the cup, by its resiliency, shields the watch from much of the vibration in driving.

Bending Welded-Steel Conduit for Electric Wiring, Which Eliminates Threading and Corner Boxes

STEEL TUBE TO HOLD WIRING REQUIRES NO THREADING

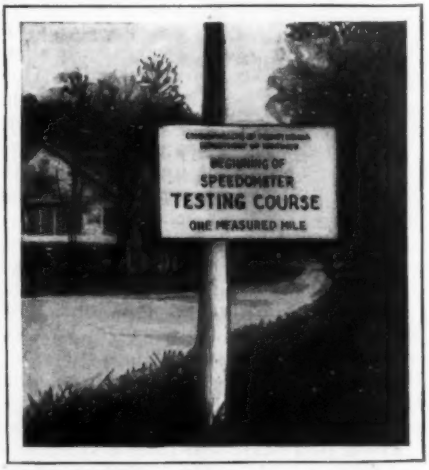
Steel tubing for electrical conduits, formed with an electrically welded joint, simplifies work considerably, as it is equipped with patent couplings which eliminate threading, and can be bent to go around corners, instead of being threaded and screwed into special corner boxes. The tubing also weighs less than half as much as the old-style conduit.

RED-HEAD ACTORS FOUND BEST FOR TELEVISION

Red-headed people are the best subjects for television, while blondes, in general, are the poorest. This curious fact was brought out by V. A. Schoenberger, radio engineer, in addressing the federal radio commission, during the hearing on the advisability of allowing television transmission by stations in the broadcast band. Dr. Lee De Forest, radio pioneer, said that after the war-time restrictions on radio were removed in 1919, he began sound broadcasting on a small scale. He subsequently moved his station, and one of the government radio inspectors took advantage of a technicality and suspended his license. To Doctor De Forest's protests he replied that "entertainment by radio had no place on the ether." "The radio commission should not repeat this early policy of discouragement, but should give television all the encouragement possible," Dr. De Forest said. Similar views were expressed by C. Francis Jenkins, Washington inventor, who urged that radiovision should be allowed on broadcasting wavelengths. The importance of broadcasting on a frequency between 1,500 and 550 kilocycles, that of the broadcast stations, comes from the fact that millions of people are equipped with radio sets capable of tuning in these waves.

DRIVERS TEST SPEEDOMETERS ON MILE-LONG STRETCH

Motorists are afforded an opportunity to test their own speedometers on a mile-long stretch of road which the state of Pennsylvania has provided at a point on the Delaware Water Gap main highway. Signs, 1,000 feet from the beginning of the test mile at each end, announce the trial stretch. The course is not a level straightaway, but has curves and grades and thus pictures true driving conditions rather than the ideal. This assures a more accurate testing of the speedometer both for mileage recorded and speed registered.



Measured Mile on a Pennsylvania Road Laid Out by the Highway Commission for Speedometer Testing

HEARING *through your* FINGERS

Six-Year-Old Deaf Child Studying the Printed Word, Lip Reading and the "Feel" of the Same Word through the "Teletactor," All at One Time; the New Device Speeds Education

NATURE is a great compensator. Rob us of our arms and we use our toes to write with. The loss of the right hand is soon compensated by new abilities developed by the left. The loss of the feet gives amazing versatility to the arms. Now our scientists tell us that we have only begun to scratch the surface of the possibilities that lie in utilizing nature's ability to increase the skill of another sense when one is lost.

Of all the five senses, touch is the most adaptable to increased uses. The trained sense of touch helps greatly to compensate for the loss of sight. Now it has been discovered that the sense of touch will also compensate for the loss or even the absence of hearing.

Dr. Robert H. Gault, of Northwestern University, became interested in exploring the limits of this amazing sense of touch. He discovered that the sensitivity of the skin could compensate for lack of the ability to hear.

A little more than five years ago, Doctor Gault extended a speaking tube between two walls and the intervening room in his laboratory. This was his only apparatus, excepting a double-walled well-packed box into which one end of the tube projected. The whole was soundproof. One of his students crawled into the soundproof box and poked his arm through the hole, placing the palm of his hand tightly over the end of the long tube. By his sense of touch he could then feel the experimenter's voice at the other end of the tube and was soon able to distinguish thirty-eight words.

Here was an amazing fact. It was proved possible to distinguish words by the sense of feeling. Hearing by touch was thus

demonstrated. That was the simple beginning.

In order to perfect such a device, Doctor Gault next linked a suitable electrical apparatus to the system for conveying the vibrations from the voice. He believed that speech could thus be communicated to the skin. The skin could be made to hear.

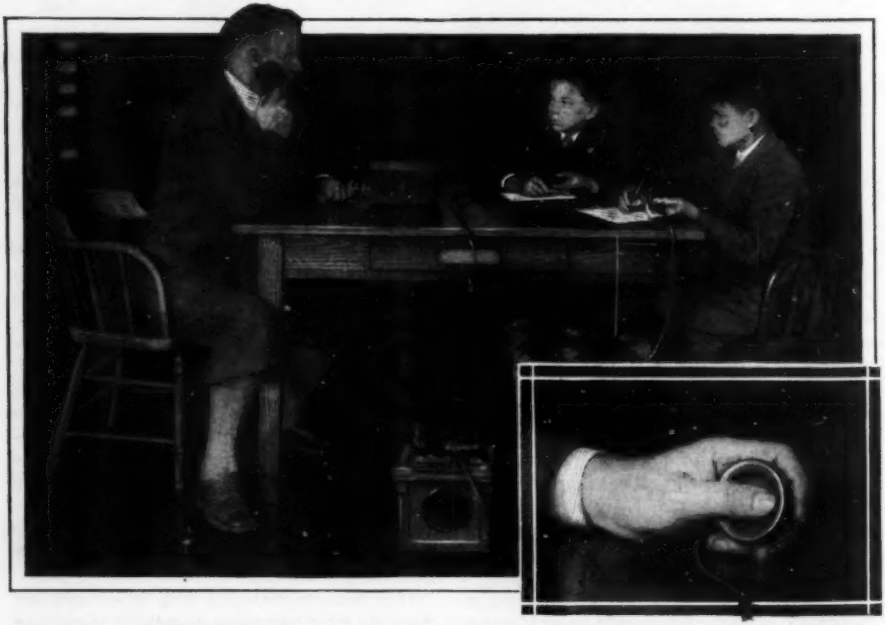
He utilized the earpiece of the telephone for further experiments. The wire connecting the transmitter and the earpiece of the device was spliced so that he could take up his position at the transmitter end. Then, while he was talking in one building, and the listener in another, holding the receiver end in his fingers, sounds could be felt. Naturally, the meaning of the sounds at first could not be understood by way of this sense of touch, but some distinctions could be easily made between sets of vibrations, and ultimately these could be correctly translated. At this juncture, the Bell Telephone laboratories extended their aid in perfecting the device, and the vibrator which was held in the hand and extended the sound to the skin by means of vibrations, was invented.

Here, then, was a simple device that opened a whole new world to those who were deaf or hard of hearing. The world of sound could be reached through the gates of touch. The sensitive fingertips would answer the purpose of the ears.

Doctor Gault, in making practical application of his experiments, immediately thought of the valuable aid such a method would be to those who were wholly or partly deaf. Since there are about 100,000 persons in the United States who are totally deaf, and a far greater number partly so, and millions whose hearing is impaired, there seemed a real chance to make a useful application.

Deaf children and deaf adults who were introduced to the "teletactor" quickly learned to distinguish the pattern of the sounds they felt. By understanding the pattern of speech they easily learned the words and were able to "hear" themselves speak. Then, by a comparison between the feeling of their own words and the feeling of the words of one who spoke correctly, they could discover the difference and learn to speak as they should.

Some deaf people obtained a real thrill



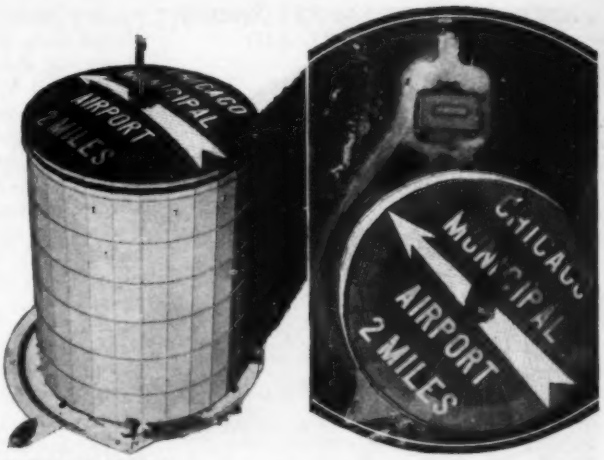
Boy Students Feeling Words While Watching the Instructor's Lips Form Them, and, Inset, the Sensitive Diaphragm Which Communicates Sound Vibrations through the Thumb

from the feel of their own voices. Certain vowel sounds gave them distinct pleasure. Some voices were found to be more pleasant than others. They showed that they enjoyed the feel of some sentences and some writers more than others. Out of ten varieties of verse, the biggest thrill for the totally deaf was the following:

"How does the water
Come down at Lodore
From its sources that well
In the tarn by the fell?"

This is fundamental. It is due to the fact that there is a predominating vowel quality: long and broad. Such sounds offered as distinct a pleasure to the one who had never heard with his ears but now heard through the sense of touch, as the normal individual would derive from any music.

The uses to which the simple little "teletactile auditors" will be put are easily imagined, and the ultimate possibilities too numerous to comprehend when applied to the sciences of human behavior, to business and to pleasure. There are immediately offered the pleasures of the radio, that thus will reach an audience of millions formerly beyond its reach.

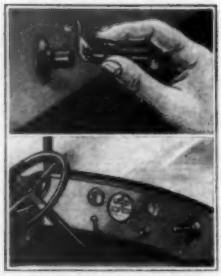


© Chicago Aerial Survey
Converted into an Aircraft Beacon, a Huge Gas Holder in Chicago Now Guides Flyers to the Airport

GAS TANK DIRECTS AVIATORS TO LANDING FIELD

When a huge gas tank was erected on the outskirts of Chicago, fear was expressed that the dull-gray structure might prove a menace to airplanes, flying for the landing field not far away. Instead of being an obstacle, the tank has been made a guide to the flyers by painting a huge sign on top of it and installing lights on its sides and at the peak in the form of a flashing beacon. The letters in the sign are each thirty feet high and the top itself represents an area of an acre and a quarter, so that the directing arrow and sign can be seen from a great altitude. The lights are also visible at a long distance.

SUCTION-GRIP CIGAR LIGHTER LATEST MOTOR LUXURY



Attached to the dash or any other convenient place in the car by a rubber suction cup, a cigar lighter ignites when the cap is pulled off. To install the device, it is not necessary to bore holes or insert screws. The vacuum cup holds the lighter firmly in position but may be removed and placed elsewhere quite as easily as it is affixed.

LAND SHIP AIDS TRAINING OF NAVAL STUDENTS

A steel platform shaped like the bridge and bow of a ship has been designed at Mare Island navy yard, on the Pacific coast, for the training of R. O. T. C. students at the University of California, Berkeley. The bow revolves on a circular track, being controlled by a steering wheel on the bridge. The usual bridge instruments, including a compass, are mounted before the wheel, and the student learns certain aspects of navigation without leaving the campus.

MIRROR SET ON SAFETY RAZOR LATEST TRAVEL AID

Shaving Mirror Attached to the Razor Handle Solves the Problem of Seeing the Blade at Work

Quickly attached to the handle of the safety razor, an adjustable mirror has been introduced for the convenience of campers, travelers, and others. It is fixed on a telescoping rod so that the distance between it and the eye may easily be regulated, and has a screw clamp that fits any make of razor. The attachment weighs but two ounces and folds into small space.

SHOCK ABSORBERS ADD TO LIFE OF AUTOMOBILE TIRES

Exploding the theory that shock absorbers aggravate tire wear, experiments made by the engineering experiment station of the State College of Washington show that tire wear is reduced when shock absorbers or snubbers are used. "Excessive wear on corrugated roads is due to tires leaving the surface of the road, speeding up while in the air and being checked again when striking the road surface," Dean H. V. Carpenter explained. "Some students of the problem have believed that, since absorbers tend to pull down the car body when the springs try to throw it high in the air, this same pull would lift the axle and tire off the road and so aggravate tire wear. Our studies show that the principal tendency to vibrate when driving over washboard highways is found in the axles themselves, and the application of shock absorbers tends to limit actual vibration. This is especially true when the disturbance comes from equally spaced corrugations, which tend to build up a resonant vibration of extreme magnitude in the axle, thus causing it to leave the road. It is this slowly built-up vibration of large amplitude that modern shock absorbers are so effective in preventing. It is a well-known fact that shock absorbers will reduce spring breakage. This can be explained in the same way. Most important of all, shock absorbers prevent, to a large extent, the tendency of the car to cut more and deeper corrugations in the road surface."

GUARD FOR HOUSE WATER PIPES PREVENTS FREEZING

To keep the house water pipes from freezing, a protective device has been introduced in the form of a trap arrangement installed in the system at the point where the supply pipe enters the dwelling. The unit thins the stream into a wedge formation, thus permitting it to freeze at a higher point than would be required to freeze the main pipes. When the trap freezes, a spring release automatically drains the pipes in the house. When the trap thaws, the action is reversed and water again flows back into the house system.

¶Write our Bureau of Information, if you wish to know who makes or sells any article described in this magazine. Send no postage; the service is free.

ARCH BRIDGE IN AUSTRALIA TO HAVE RECORD SPAN

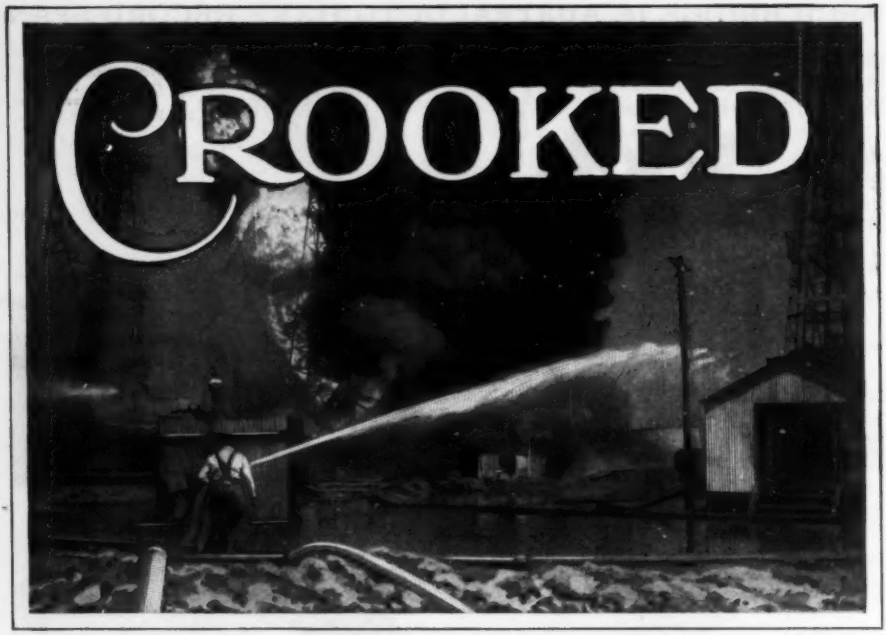
Building the Approaches for the New Harbor Bridge at Sydney, Australia; It Is to Have One 1,600-Foot Span

One of the greatest engineering tasks of its kind is under way in the harbor at Sydney, Australia, where a huge arch bridge is under construction. It will be 3,770 feet long and will have a center span of 1,600 feet, with a clearance of 170 feet above the water at mean high tide. More than 56,000 tons of steel will be used. The bridge will be 150 feet wide, providing passage for four railway tracks, a road, fifty-seven feet wide, and two footpaths, each ten feet wide. It will be completed in 1931.

CUTTER REMOVES TREE ROOTS WHICH CLOG SEWER

A cutter that can be drawn through a sewer to sever tree roots which threaten to clog the drain has been invented by a city councilman of Nappanee, Ind. The cutter, which works on the same principle as a folding luggage rack, can be expanded or contracted from ten inches to twenty-nine inches, to fit any drain within those limits. It is fitted with five sets of double knives, and when drawn back and forth between two manholes by a windlass stationed at each end, the roots are severed by the knives, which operate in V-shape formation, like the blades of a pair of scissors. In their search for water, trees send fine tendrils between the joints in sewer pipes and the resulting matted growth often completely clogs the drain. The cutter has been tested with success.

CROOKED



When the Getty Number 1 Well, at Santa Fe Springs, Caught Fire, Ten Thousand Barrels of Oil and Forty Million Cubic Feet of Gas Were Burned Each Day

By THOS. M. NELSON

STANDING three hundred feet apart, two gaunt steel oil derricks reared their structures high into the air. One belonged to the Texas Moon, the other to the Hardrock corporation, and each was bending every effort to beat the other down to the pay sand. The Texas Moon log showed a depth of 3,107 feet; that of the Hardrock corporation read 3,098. It was a close race.

Both derricks had been the scenes of intense activity, with mud pumps clanking and throbbing in rapid cadence, but now both were inactive, and the men sat about with expressions of bewilderment. Bob Rankin, driller for the Texas Moon, was talking to Red Malone, the Hardrock driller.

"Somethin's wrong," Rankin was saying. "Never before did I see a rotary drill act like mine was doin'—jumpin' around until I thought the blamed derrick would shake t' pieces. I sure . . ."

"Yeah," interrupted Malone. "My rig's gone crazy, too. Seems there's somethin' way down deep in that hole grabbin' and poundin' at the bit."

For a minute both men were silent as they mulled the matter over in their minds.

"Say," exclaimed Malone, "I'll bet these two oil wells have run together down there somewhere—that's what makes our rigs act so queer."

"We can soon tell," snapped Rankin. "You start your mud pump to workin'; I'm goin' back over to my rig and pump a lot o' red paint down our well. If you pump some red out of yours, that'll show the holes have run together."

Rankin hurried back to the Texas Moon derrick. Malone started his pumps, and the thin mud began to boil out of the top of the hole. Five minutes passed, and nothing happened. Then ten, and the mud took on a pinkish cast; the two wells had met far down under the surface of the earth.

The two shafts were being dug with rotary drills. These are exactly what the name implies. A bit shaped much like

HOLES

The Test of a Crooked Hole, a Bottle Etched by Acid to Show the Angle of Inclination

the tail of a fish, is screwed to the end of a joint of heavy steel pipe, and the pipe is rotated, the bit cutting its way into the rock just as a carpenters' bit cuts through a tough plank. As the hole increases in depth, joint after joint of pipe is added. Down through the drilling pipe, thin mud is pumped to serve the double purpose of a lubricant to reduce the heat caused by the friction of the bit against the rock, and to wash the rock cuttings and debris out of the hole.

When a bit becomes dull, or some other reason necessitates a withdrawal, the entire length of drilling pipe must be pulled out of the hole. When the shaft is several hundred feet deep, this is an arduous task, taking several hours' time. To save time in "coming out of the hole" and "going back in the hole," or as the drillers say, "making a round trip," it is customary to break the pipe every three or four joints, stacking these pieces in a corner of the derrick.

Bruce Pilley, drilling superintendent of the Texas Moon, and George Sloan, who held a similar position with the Hard-rock, both arrived at the scene of the crooked holes at about the same time. They were friends, though business rivals.

"What's the idea of letting your well wander over on our side of the line?" the Texas Moon drilling boss asked the Hard-rock chief.

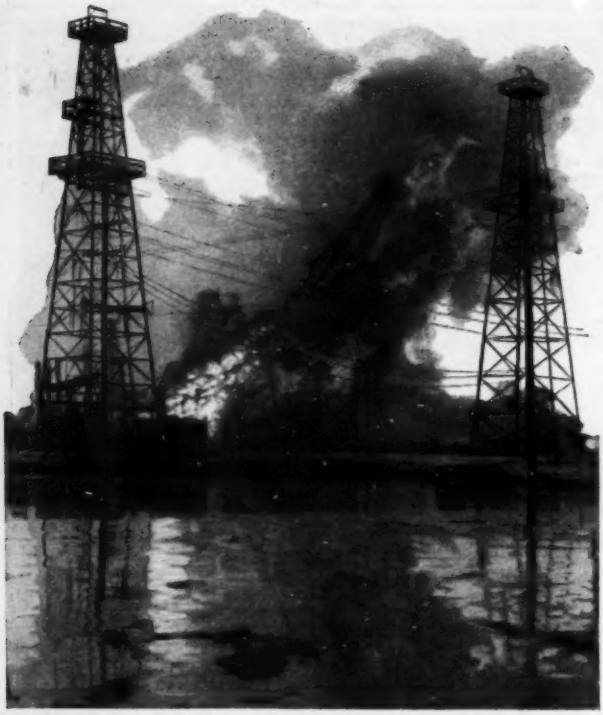
"Our drill on your property? Why, it's the other way around; your tools came right over and invaded our hole."

"Well, we won't argue about it. Seriously, what do you think we ought to do about it? Seems a shame to abandon two perfectly good holes because we don't know which side of the line the bottom is on."

"Suppose we determine which well is off center, then we can let the guilty party sidetrack his well," suggested Sloan.

"Okay with me," replied Pilley. "The sooner the better. The drilling crews can be getting the rigs ready for the test while we drive into the city for the necessary material."

In the case of wells made with rotary drills, there are two common methods of determining the amount and direction of deviation of the hole from true vertical, which has been known to be as much as 900 feet. The first, and the least satisfactory, employs gelatine and a magnetic compass. Into a small vacuum bottle, which fits snugly into the inside of the drilling pipe, cooked gelatine is poured. On the fluid gelatine is placed a floating magnetic needle. The bottle is then tightly sealed, placed in the drilling pipe, which is lowered into the hole. One of the bottles is placed every 200 or 300 feet in the drilling pipe, and after the entire length of pipe is lowered, it is allowed to stand for several hours. The theory is this: The vacuum bottle should hold the heat of the cooked gelatine for some time, keeping it in a fluid state until the entire length of pipe is in the hole. As the heat gradually radiates away, the gelatine will slowly congeal, and the angle the sur-



Getty Number 2, at Santa Fe Springs, Also Burned; This Photo Was Snapped Just as the Steel Derrick Melted and Crashed

face of the gelatine in the bottle forms with the perpendicular will give the amount, in degrees, that the hole varies from plumb. The magnetic needle which will become fixed in the congealed gelatine, will give an accurate check of the direction the hole is dipping.

In practice, this method is frequently a total failure. In some cases the heat encountered at increasing depths is sufficiently great to keep the gelatine in a fluid state, and in cases where the gelatine does congeal, the magnetic needle is in error, due to the attraction of the steel drilling pipe, or of certain minerals.

The second, and more successful, method of determining the deviations of oil wells, employs wide-mouthed glass bottles containing a solution of hydrofluoric acid. As in the case in which gelatine is used, the bottles are placed about every 300 feet in the pipe. After the entire length of pipe has been run into the hole, it is allowed to stand for two hours. The acid has the property of corroding, or eating, glass, thereby etching in the glass bottle the exact angle at which the pipe in the hole is resting, thus giving the course the wandering oil-well drill may have taken.

Pilley and Sloan used the acid method to determine which well had so far wandered from its intended course as to infringe upon the property of the other.

Two hours passed, and the crew started to raise the pipe from the well, carefully labeling each bottle as it was removed. Finally, the engineers who were working on the figures pushed aside their scratch pads, indicating that they had finished.

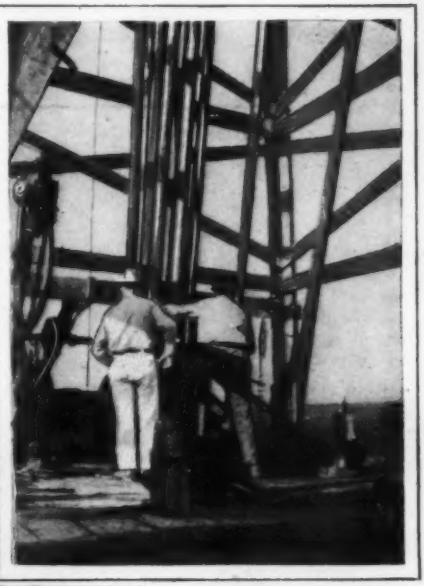
"Who won?" shouted Pilley and Sloan as one man.

"You both lose," replied the engineer laconically. "The two wells came together exactly on the dividing line of the properties."

Another problem in the oil fields is fire. After a two months' battle with a flaming oil well had been successfully terminated, engineers of a California oil company were confronted with the much more serious problem of extinguishing a three-million-foot gas-well blaze. Getty well No. 1, after causing a damage of nearly $1,000,000, had hardly grown cold when the new outlaw well was brought in a few hundred yards away at Santa Fe Springs, Calif. The new well, known as Getty No. 2, came in with a terrific rush of gas, sending a geyser of mud and stones high into the air. A stone striking some of the metal work provided the spark that turned the well into a roaring inferno. The steel derrick melted and collapsed like spiderweb in the blaze. As there was little or no oil mixed with the gas, it burned with a brilliant white light that

could be seen at night from a distance of fifty miles.

The first fire had been snuffed out with a huge metal cap swung from a derrick on wheels, but in this case the heat was so intense and the pressure so great that some new method of fire-fighting had to be devised. A pipe line was laid to the well, and columns of mud and steam were forced upward into the flames, but this had little effect. Finally, a pit was dug 300 feet distant, and a tunnel was begun that would reach the casing at a point fifty feet below the surface of the ground. When the tunnel was completed, a large sleeve and valve were placed around the casing, and a hole was cut in the pipe. An aluminum ball, slightly smaller than the diameter of the casing, was forced into the gas stream by means of the valve. As the hollow rotary drill was still hanging at the top of the hole, it was hoped that the ball would wedge itself into and around this smaller opening and effectually check the flow. Some idea of the great pressure may be obtained by the outcome of this attempt. The ball struck the end of the drill as expected, and it not only wedged itself in, but went on through the drill and out like a shell from a gun. Next a large inverted funnel of steel was dragged at the end of cables and placed over the mouth of the well. This increased the pressure at the outlet and lifted the flames higher above the ground, but did not sufficiently diminish the heat to enable workers to approach.



Lowering Sections of Drilling Pipe into a Well, Top, and, Bottom, a Close View of a Rotary Rig, Showing Stacked Pipe and the Mud Pumps

Finally, returning to their tunnel, the engineers laid an eight-inch pipe line to the casing and installed a large compressor and motor at the valve which they had previously placed. The motor was started, and the compressor, working at top speed, began drawing off a considerable portion of the gas and forc-

Not a Fire but an Oil Gusher, with Twelve Hundred Barrels an Hour Shooting High in the Air

ing it out into the company's lines. This plan eventually solved the problem.

The inverted funnel had lifted the flames to a height of twenty-six feet, and with the reduced pressure in the casing, the heat materially subsided. Three men in asbestos suits, protected from the blazing torch by streams of water and artificial wind from blowers, crawled to the control valve at the top of the casing and pried it loose. Companions, on the end of a thirty-foot bar, then were able to pinch off the fire as they drew the valve tight.

ART TREASURE SHIP GUARDED BY DESTROYER ESCORT

The very unusual sight of a destroyer escorting a ship, containing $25,000,000 worth of art treasures and old Dutch masters, was recently seen by watchers on the Tongue lightship in the estuary of the Thames, England. The ship—a Dutch Batavier liner—had loaded crates containing rare paintings and works of art into her hold, while two Dutch warships stood guard over the operations and lit up the Rotterdam quays with brilliant searchlights. One of the warships convoyed the ship as far as the mouth of the Thames, where she was handed over to the care of the British authorities. On the way, armed guards stood over the sealed hatches to prevent the operations of international thieves, who were suspected of having chartered a pirate steamer to make an attack on the liner, on the crossing of the North sea. The London custom officials waived the usual search on the quayside and accompanied the padded motor van, equipped with balloon tires and low wheels to resist vibration, to the exposition salon at Burlington House, Piccadilly. The motor was driven at a speed of only twenty miles an hour, straight out of the liner onto the wharves of the London docks, whence, with mounted police on either side and sharpshooters inside the van, it reached the West End headquarters of the British Royal Academy, where the seals were removed from the crates. One of the Dutch paintings, Vermeer's "Head of a Child," is valued at $500,000.

PENCIL ON EXTENSION CORD AIDS PHONE USER

Attached to a wire cord that unreels and winds up again, a pencil set has been introduced for the desk worker, phone user, and others. The pencil is kept from getting lost, is always in a convenient position, and the set occupies little space.

SEAPLANES SPEED UP MINING IN CANADIAN FIELDS

Canadian prospectors are taking to the air. Big planes, fitted with pontoons so that they can land on water, are carrying men, machinery and supplies far into the northern parts of the mining fields, traversing, in a few hours, areas that require two weeks or more by ordinary means of travel. In cold weather, the pontoons are replaced with skis so that the ships

Keeping the Airplane's Engine Warm in Winter; the Top Picture Shows a Simple Canvas Covering Serving as a Flue for a Heater; the Bottom, a Portable Workshop for the Mechanic

can land on ice and snow. Eighteen companies with more than sixty planes, are now serving the more recently developed mining districts in Canada. Flights have been made as far north as Fort Churchill on Hudson bay. One contract involved the transportation by air of thirty-five tons of supplies, diamond drills and other equipment with forty men. The air routes save delays and the labor of portages and also have another advantage, greatly appreciated by persons who know the north. Soaring at rapid rate high in the air, the traveler is out of reach of the bothersome blackfly and mosquito, two insect pests that make life miserable in the north. Heated shelters are provided for the mechanicians who look after the motors.

SLEEPING IN THE UPPER BERTH MEANS LONGER RIDE

A traveler between Chicago and Billings, Mont., travels sixteen inches farther if he sleeps in an upper berth throughout the journey, than if he takes a lower, according to figures presented to the Pullman company by a Montana ranchman with a leaning for mathematics. The computation is based on the fact that an arc of a circle with a radius equal to the distance of a Pullman lower from the center of the earth is somewhat shorter than an arc with a radius four feet greater. Actually, the ranchman went on to explain, the traveler in an upper does not gain the entire sixteen inches, as he does not spend all his time in his berth on a journey of that length. He estimated the added travel in nine hours in the upper berth at 7.6 inches.

AUTOMATIC PAINTER FOR WALL SAVES DECORATORS' TIME

Automatic Decorating Tool, Working Like a Grainer, Which Paints Designs Rapidly on the Walls

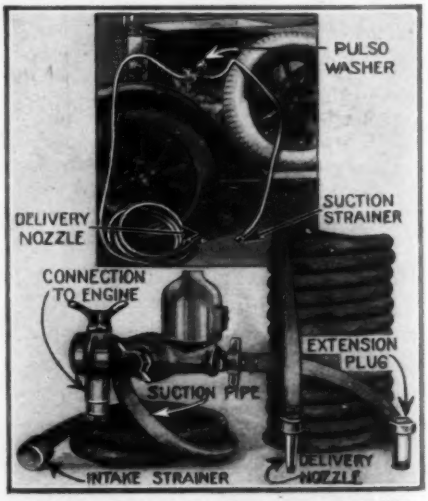
Artistic designs are quickly and accurately made on walls with the aid of an automatic painting device a German inventor has developed. It resembles somewhat the tool used to imitate the grain of woods and is easily operated. According to reports, it will do, in two hours, what would ordinarily take two days.

MIRAGE SEVEN MILES IN AIR DESCRIBED BY FLYERS

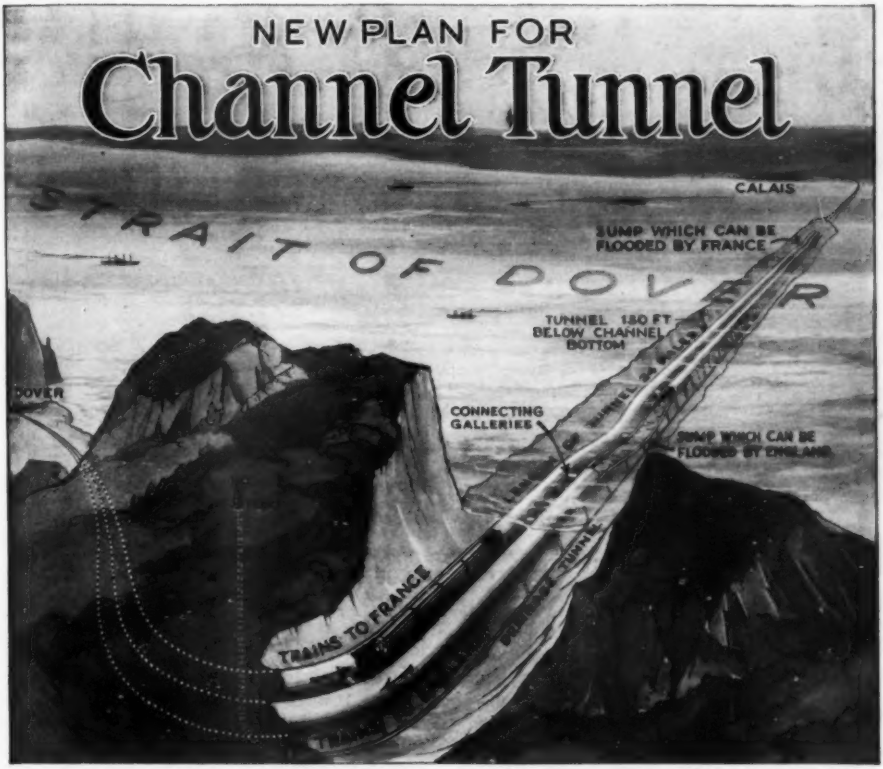
Ice caves, apparently hanging in festoons in the air, and decked in all the colors of the rainbow as the tiny ice particles broke up the sunlight, presented an awe-inspiring sight to two army flyers recently, when they rode a plane to an unofficial record height of 39,000 feet. Because they landed miles away from their starting point, Wilbur Wright field, at Dayton, Ohio, they cannot claim a record under the international rules which require altitude flights to end at the field from which they started. The flyers, Lieut. Harry Johnson, pilot, and Capt. Albert W. Stevens, the army's most famous flying photographer, blamed their failure to come down again within striking distance of their home field, when their gas supply ran low, to another phenomenon, excessive visibility. Under ordinary flying conditions, the apparent horizon is 7,000 or 8,000 feet away, but in the upper air, after they had passed through the snow and ice clouds, visibility was so good they could see a distance estimated at 50,000 feet, and could not keep track of where they were. At the pinnacle of their flight, the temperature registered seventy-six degrees below zero. When the brilliantly colored ice clouds were sighted below, Johnson dived the plane into them several times, and to make sure of their formation, removed a glove and stuck his hand out of the fuselage, with the result that it was stung in hundreds of places by the tiny ice particles. Stevens also exposed one side of his face to the blast and acquired a bad ice blister. The plane used for the flight was an old army craft which has been the vehicle used in altitude-record flights for several years.

AUTO RUNS WASHER PUMP FOR CAR CLEANING

Easily attached to the automobile motor and operated by it, a washing pump for cleaning the car has been introduced. It furnishes a strong jet of water, sufficient to remove mud and other dirt, saves time and work, and has few parts to get out of order.



Attached in Place of One Spark Plug, This Water Cleaner Gets Pressure from Suction in the Cylinder



Artist's Diagram of the Proposed English Channel Tunnel, with Sumps near Either Shore to Permit Flooding against an Invasion, if France and England Should Ever Fight

PLANS which have been considered for more than half a century for a railroad tunnel under the English Channel, connecting France and the British Isles, were revived recently in the parliament, with a strong demand that the government authorize the work. A tunnel company has been in existence for many years, and construction of approaches was actually begun at one time, but stopped when the British army general staff objected.

The army leaders voiced the same objections again this time, claiming railroad connection with the mainland would imperil England in time of war and require a huge standing army to guard against a surprise attack by train, in event of war with France.

In answer, the tunnel proponents pointed out that the plans provide for a sump near either shore, so that either England or France could flood a section of the tunnel at will, and prevent the other from using it, and that so far as danger to England went, a battery of long-range guns stationed along the French coast near Calais could bombard London as easily as the Germans bombarded Paris in 1918.

The plans being considered call for two parallel tubes, one for traffic in either direction, with connecting cross galleries at intervals for use in emergency. Smaller drainage tunnels would be sunk at a lower level, connecting with powerful pumps on shore. The length of the big bores would be approximately twenty-four miles, and the estimated cost of the project is in the neighborhood of $150,000,000.

The main shafts would be 130 feet below the deepest part of the channel, and the bore would be through a layer of chalk

The Answer to the General-Staff Objections Is That Batteries of Long-Range Guns on the Calais Coast Could Shell London without Sending an Army across the Channel

marl that is almost impervious to water. Although about three times as long as the longest existing railroad tunnel, the project does not present any serious engineering difficulties.

Proponents of the scheme point out that it would eliminate the rough channel crossing, especially bad in winter; relieve the railroad companies of the expense of building and maintaining a fleet of fast channel steamers; cut an hour and a half to two hours from the journey between London and Paris, and provide an uninterrupted means of transporting troops to the continent and getting food into England in event of another war, as neither surface ships nor submarines could interfere with the tunnel trains.

Not all of the objections raised against the plan come from the general staff. The doctrine of England's "splendid isolation" was cited in some quarters, and the fear expressed that quick and comfortable train journeys would make England a holiday resort for hordes of more or less undesirable people, who would introduce foreign customs, deface the countryside and otherwise interrupt English habits of living.

Against this view, the friends of the project pointed out that the expenditure on the tunnel would do much toward relieving unemployment, particularly among miners, who could be used in the construction work.

GOLF TEE IS SET AT ANGLE FOR LONGER DRIVES

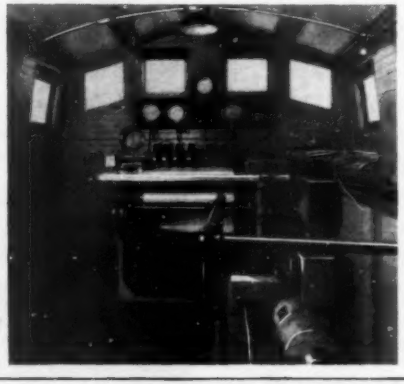
Inserted in the turf at an angle and so curved that it allows the ball to leave with less resistance, a golf tee now on the market is said to give longer drives. The club head strikes the arm of the tee, causing it to drop, leaving the ball suspended in mid-air where it receives the full benefit of the force of the swing. After the stroke, the tee is usually at its original position, since there is nothing for the club to catch upon.

TONS OF DRIED GRASSHOPPERS FED TO ZOO ANIMALS

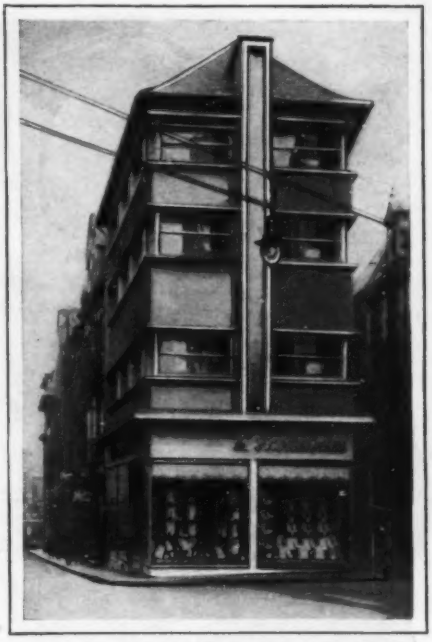
Two tons of dried grasshoppers were ordered from South Africa recently for animals at the National Zoological Park, at Washington. They were for the diet of some of the rare African birds and also for mixing with the food of some of the mammals, according to zoo director, Dr. William M. Mann. Valuable elements are combined in the proper amounts in the insects, experts have found, and few satisfactory substitutes for them have been discovered.

ROBOT RIDES RAILROAD TRAINS TO TEST ENGINES

Housed in the cupola of a specially constructed steel coach, a mechanical man is riding trains of the Northern Pacific railway to show how locomotives behave while on duty. The apparatus checks and records, on each of its twenty-two fingers, an engine's reaction when under performance in drawing trains, and has been devised to save money for the railroad and, at the same time, increase the power of steam locomotives. The car is so equipped with delicate instruments that it will register the steam pressure, speed, air pressure and many other features which enable engineers to compute the actual pulling power of the locomotive. The "man" is at the head of the car, and as the train proceeds, a series of pens record on a roll of continuously moving paper, such data as drawbar pull, shock, speed, train-line air pressure, steam pressure, distance marks, stations, mileposts and other facts, so that a written picture of the engine's performance is obtained for analysis in combination with track conditions over the particular line and section where the test was made.



Interior of the Engine-Testing Railroad Car, Showing Chief Parts of the "Mechanical Man"



Front View of the All-Steel Building Erected in Essen, Germany; Note the "Groove" for Exterior Lighting

BUILDING OF NON-RUST STEEL HAS NOVEL LIGHTING

At a street intersection in Essen, Germany, stands an interesting building that gives a hint of what the future city may adopt in place of masonry. It is constructed almost entirely of non-rusting steel, a material that has been used for some time in household utensils and surgeons' instruments but now is adapted to the building trade. An unusual feature of the structure is the vertical lighting arrangement on the front, whereby illumination is thrown up the grooved supports. Door and window frames, latches, etc., are also of the special steel.

Tricks of

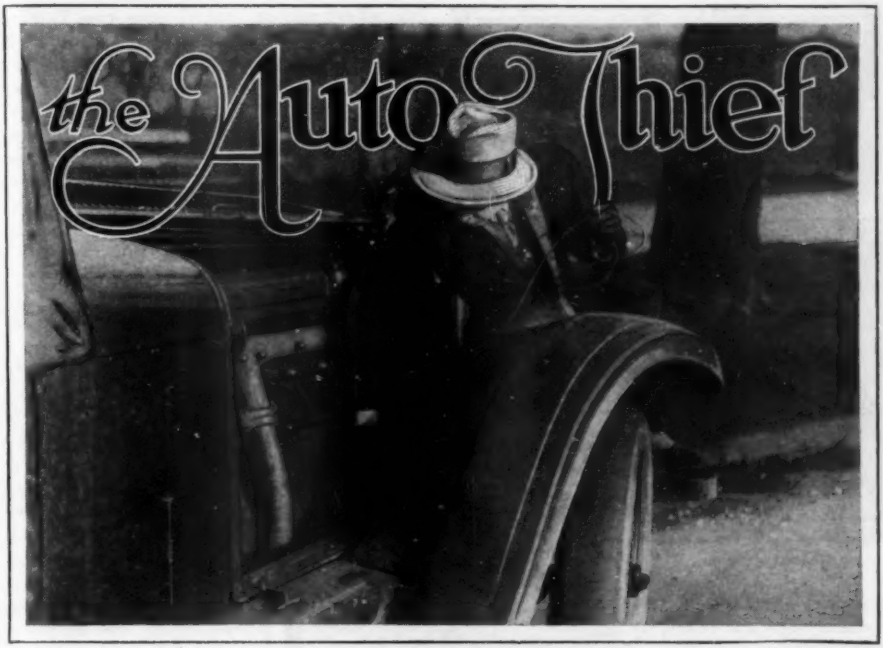
John J. Farrell, head of Chicago's stolen-automobile section of the detective bureau, is one of the chief reasons why automobile thieves prosper as they do. Some 200,000 cars are officially reported stolen each year. Possibly eighty per cent of them are recovered. But insurance companies have found that the average loss on a car, "just taken for a joy ride" and then returned, is about $150. Conservative estimates place the yearly net loss through automobile thefts, simply on cars

HE WAS proud of his automobile. It was one of the latest models and he had paid only about one-fifth the usual price for it. He enjoyed it for just three days, then a policeman called. "I'm sorry, Mr. Blank," he said, "that's a stolen car. We've found the owner."

This happened to a business man the other day, a man known for his shrewdness and for his absolute honesty. In an unguarded moment, he had neglected to "look his gift car under the hood." If he had, he might have discovered that the serial number had been altered. The digit 3 had been changed into an 8. But he had not suspected that anything was wrong, and the bargain had been too good to overlook. So he lost the car and what he had paid for it.

Carelessness on the part of buyers of secondhand cars, in the opinion of Lieut.

Thefts of Accessories Cost Motorists a Fortune Yearly; Center, Unlocking Car with Duplicate Ignition Key



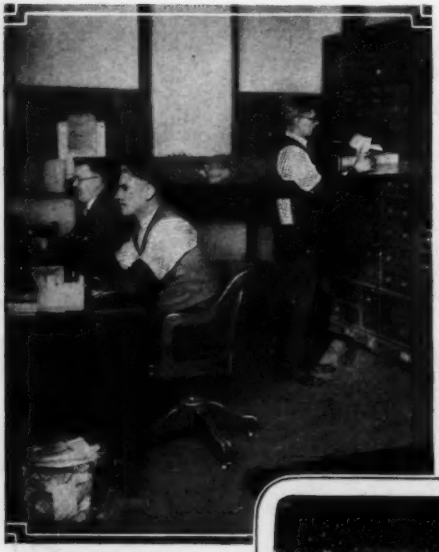
Another Way of Doing It; "Jumping the Ignition" by Placing a Wire across Ignition to Spark Plugs and Operating Car without Resort to Ignition Key

reported, at more than $50,000,000. Add the estimated number of stolen cars not reported, and the grand total doubtless is well in excess of $100,000,000. And this in a country where, but a few years ago, it was common to lynch horse thieves!

"It is curious," said Lieutenant Farrell, "but a man will cheerfully pay as much as $1,500 or more for a used car, if he thinks he is getting it at a bargain, without satisfying himself whether it is stolen. But in the case of a building lot, for instance —something that cannot be driven away or lost—he will go to elaborate trouble to investigate the title, even if the land costs but a few hundred dollars. If the second-hand automobile buyer would beware, thieves would find their business cut in half. They steal to sell and they can sell, because, as in the case cited, the buyer rarely makes a thorough investigation as to the title of his purchase.

"Of course, the greatest vigilance will not detect every stolen car. But anyone can exercise a few simple precautions. Try to know something about the dealer. Find out how long he has had the car. Don't be too eager to purchase one that has just been driven in. Ask for the bill of sale the dealer received when he bought the car. If you doubt any of the numbers, have them examined by an expert. Some of my men are so efficient in this that they can detect a forgery simply by running their fingers over the figures.

"Call your police department and ask if they have any report on the car. If you care to go to further pains, ask the same of one of the automobile-theft bureaus. There are five big ones that cover the entire country. They have records of every car reported stolen by their clients. If you still have doubts, write the manufacturers, giving the engine and other numbers that you find. They will compare these with their records and, if any discrepancy is found, an investigation will be in order, for all car numbers, including the so-called 'secret numbers' on obscure parts, and in other places where the average layman or mechanic never sees them, are issued in a prearranged system, that



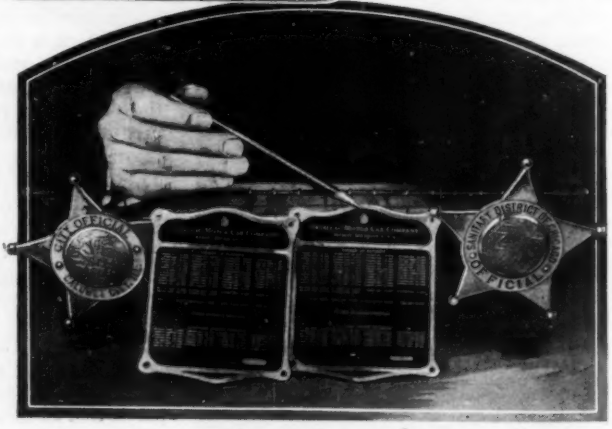
ing wheel is not locked, one crook may break open the door, get in, and steer while a confederate, in another car behind, will push your car down the street, into an alley and, perhaps, into a garage where it is dismantled or disguised for sale. This method is called 'kissing them away,' and it is worked almost every day. It pays to have a good locking system, however. A lock that secures both the steering gear and the ignition is one of the most effective.

"A favorite scheme of the thieves is to operate in a party of four, two men and two women. They go to a fairly large-sized city, register at a good hotel and, the next day, the men appear at an automobile dealer's where the make of car in which they are interested is sold. Remember, practically all the thief rings specialize in certain makes of automobiles and rarely will bother with others. The reason is that they are especially equipped to disguise just those and no other kind, and they also find quicker sales for certain makes, especially new cars.

"The men explain to the dealer that they are driving to the coast

is, a certain serial number will accompany a certain engine number, carburetor number, and so on. Any change, therefore, is easy to detect. Every number should agree with the original sequence unless there have been alterations.

"There is no such thing as a thief-proof car. If they want your automobile badly enough, the thieves may break open your garage and truck it away or adopt the same method if it is on the street. Thieves sometimes have service trucks and pose as legitimate repair men. If they take your car and are detected, they plead a mistake, or say that they were ordered to get the car but confused it with another one of the same make and model that may or may not have been standing close by. If the steer-

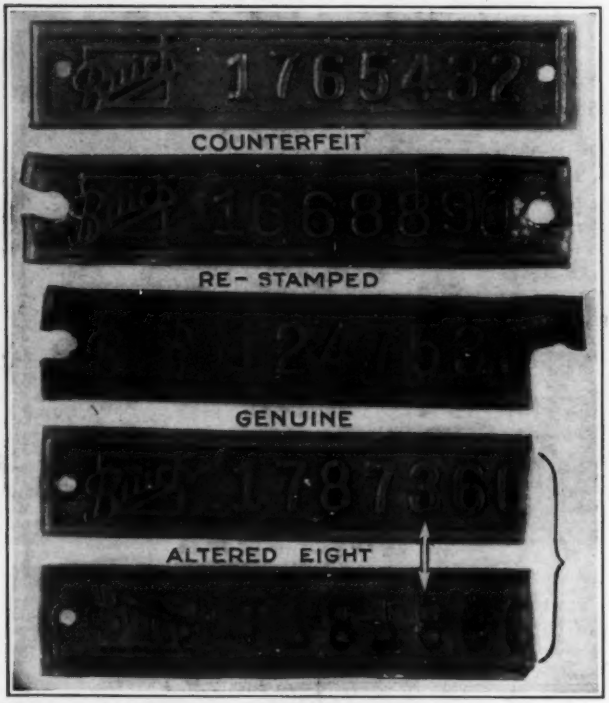


Interior of Stolen-Auto Division, Chicago Detective Bureau; Motor-Block Numbers Restored by Heating, and, Bottom, Trappings from Stolen Cars; Pencil Points to Counterfeit Plate; Thieves Sought Immunity with Stars

Thieves Towing Away a Parked Car and, at Right, Breaking a Gear-Shift Lock

from New York. Their own car broke down, and since it will take considerable time to repair it, they have concluded to purchase a new car and continue their journey without delay, they say. The salesman shows them a late model and is doubly pleased when his customers agree to pay cash in full. They give their hotel as their address, explaining that they do not expect to return to their New York homes for some time. Just after the bill of sale is made out, No. 2 of the duet, who, up to this time, has let No. 1 do most of the talking, goes into action. 'Say, Jack,' he exclaims, 'hadn't we better telephone the womenfolks and let them know we've bought the car and arrange to meet them somewhere?' 'Good idea,' No. 1 replies. 'May we use your telephone, Mr. Salesman?' The request is naturally granted, and as No. 2 takes his seat at the desk, No. 1 steers the salesman to the rear of the store. No. 2 watches his chance and, as he telephones, stuffs a number of the company's bills of sale into his pocket. Then he joins the others, and soon the men drive away with their car.

"But they do not go to the hotel. They already have chosen a garage somewhere for their headquarters, a private one for which they have the only keys and on which they have paid a month's rent. The new car is stored there and, perhaps that night, the enterprising crooks go out and steal a car, as new as possible and of the same make and model as the one they purchased. Engine number plates and other parts are taken from their car and placed on the stolen one. In a day or so, they have an alluring bargain for some unsuspecting purchaser. If he asks verification of ownership, he is shown the bill of sale and cheerfully referred to the dealer. 'Why, yes,' the merchant says, 'those gentlemen were in here a few days ago. I sold them that car, gave them the bill of sale and everything is all right.'



Sample Numbers Showing Counterfeiters' Skill; the Altered Figure Eight at Bottom Was Not Discovered Until Tag Was Removed

The scheme rarely fails at this stage, for the bargain is too tempting and, so far, the purchaser has no reason to suspect fraud. Possibly the stunt will work four or five times in the same city before the thieves decide to go on to other fields. Counterfeit numbers are placed on each stolen car to agree with the original numbers on the bills of sale.

"Some thieves make a specialty of buying wrecked or burned cars as junk. They receive a bill of sale, salvage parts which they place on stolen cars, and so disguise the finished automobile as a legitimate car for which they have the bill of sale. Occasionally thieves visit a railroad yard where a shipment of automobiles is being unloaded. They drop a battery and an emergency tank of gasoline into one of them and drive it away. Sometimes the car is sold before the dealer realizes that it is missing from his lot, and he is naturally incredulous when the police tell him that the car has been stolen.

"A sharper will purchase a car from a dealer, make the first payment and then let the next lapse. The finance company advises him that the car will have to be taken back unless the account is brought up to date. The crook steals a car of the same make and model, and as nearly the same age as the one he bought, switches numbers, leaves the stolen car in front of his house and hides the one he bought in a garage. The next morning, the stolen car is hauled away and a week or so later, the crook appears in the first car. He may drive it for several weeks before the fraud is discovered.

"More careful investigation of secondhand cars before purchasing, always locking both steering gear and ignition, prompt reporting of the fact when the car is stolen, and more vigorous prosecution of automobile thieves when they are caught; these and other methods will help to cure the stolen-car evil. The situation today is bad, but there is room for hope. For instance, eleven of the largest middle-west cities reported 32,291 cars stolen during the first nine months of 1928. That was a large number, but still it was 4,259 less than during the same period of 1927, in spite of the great increase in the total number of automobiles in use. Several cities made a creditable showing. In Chicago, 1,308 fewer cars were stolen and the recoveries mounted to ninety per cent. In Detroit, there was a decrease of 5,940 in the number of auto thefts. This means that cities are learning the ways of the automobile thief, fewer thefts will result in cheaper insurance rates and eventually there will be a decrease in crime of all kinds as a result of the curbing of the auto thief, for in most of the major offenses, such as murders and big holdups,

the stolen car is an important factor." E. L. Rickards, secretary and manager of the Automobile Protective and Information bureau in Chicago, one of the five big divisions under the National Automobile Theft bureau, sees a cure for the situation in better state laws that will demand certificate of ownership and proper registration of titles, together with complete record of serial and motor numbers of all cars registered, properly recorded and indexed, and an interchange of information on stolen cars by the various state departments.

"A man or woman who leaves his car unlocked and unattended, is committing an offense against society," said Mr. Rickards.

RACK FOR MAGAZINES HOLDS MANY BACK NUMBERS

Several advantages are claimed for a magazine-filing cabinet that keeps the latest issue in plain sight, and where it easily can be grasped, besides providing space for back numbers. It consists of a series of drawers, one for each magazine. The late copy is supported on the outside and the others are obtained simply by pulling out the drawer which is open at the top and one side. The file is made in three sizes.

Novel Magazine Rack Displaying Current Numbers in Front, While Back Copies Are in Drawers

Painless Eyebrow Plucking with Spring Tweezer Which Gives a Sharp Jerk When Button Is Pressed

TWEEZERS PULL WITH SPRING TO REDUCE PAIN

Spring tweezers that give a short, sharp jerk when a little button is pressed, have been introduced as an improvement over the usual type. They make extraction of hairs practically painless, as the spring pulls faster than is usually possible by hand methods. After the spring has once been released, it is quickly set again, and the entire operation can be executed with one hand.

GIANT TIMBERS ARE SHIPPED ON SPECIAL CARS

Shipping thirteen giant timbers for a new dredge being built at Parkersburg, W. Va., required special preparation by the railroads handling them recently. Each of the timbers, cut from 200-foot fir trees, was 102 feet in length and eighteen inches square. To handle them, three flat cars were used, and the timbers were supported on cradles pivoted on the two end cars, without touching the center one. In this way the timbers were free to move so that the cars could take curves without difficulty or danger.

Vanity Case in a Ring; the Set Tips Back to Reveal a Mirror and a Small Amount of Rouge

RING THAT HOLDS ROUGE STICK ALSO HAS MIRROR

Underneath the setting of a ring now on the market, is a small compartment for lip or face rouge. The setting tips back as a lid, and the underside of it is fitted with a mirror, so that the ring serves as a small make-up outfit.

TO MAKE RUBBER PLANTS PAY IS REAL PROBLEM

There are easily 1,200 species of plants in the world that have rubber in their veins, as Thomas Edison said in his recent birthday message. There are probably nearer 12,000 such species, if we take into consideration all that have even a little rubber. The problem is to make any of them pay, and especially to make any of those that are hardy in temperate climates into paying sources of the gum that bounces. If Edison's hopes of establishing rubber plantations in the United States are to be realized, either hardy forms of the present rubber-yielding plants of the tropics will have to be evolved, or certain rubber-yielding plants native to the temperate zones will have to be bred up to a point where their rubber content will pay for its own extraction. All the present rubber trees and vines are warm-climate plants. The Para rubber tree, Hevea, which now produces by far the larger part of the world's crop on the East Indian plantations, is decidedly a tropical form. It will just consent to grow in southern Florida, but will not grow for money unless it is permitted to hug the equator. It is out of the question for the United States proper, though it would thrive in the Canal zone and the Philippines. In our own semiarid southwest, and more extensively in the adjacent states of Mexico, there is a native bush, the guayule, which contains rubber in paying quantities, but even this native rubber plant requires the desert heat for profitable growth and holds out little hope of becoming adapted to the colder north. There remain native plants like the milkweeds and dogbanes, which yield a milky juice containing a little rubberlike material. These are hardy enough for the north, but their content of resilient gums is so low that it would be a bold undertaking to try to make them into commercial sources of rubber, even with the best methods now at the disposal of the plant breeder.

SKATES FOR CHILD'S SCOOTER AID WINTER SPORT

In a few moments, the child's scooter may be converted into a vehicle for winter sport by the addition of special skates now on the market. They are said to operate effectively on either ice or snow, permit quick turns in safety and allow considerable speed.

Adding a Pair of Special Skates to a Scooter, in Place of the Wheels, Turns It into a Sled

Close View of the Rescue Buoy; Cover Removed to Show the Reel for the Life Line and Space for Other Articles; Right, a Launching

BUOY TO CARRY LIFE LINE AIDS IN RESCUES

One of the most difficult tasks in effecting rescues at sea—getting a line to the distressed steamer—is simplified by a special buoy that is put overboard from the rescuing boat and is allowed to be driven by the wind and currents to the wreck. Besides the line, contained in a chamber inside, the float has a calcium light for night work, a container for the ship's log and other valuable papers, and is so constructed that it will anchor itself in sand or among rocks. The line is played out from a reel within the buoy itself.

REFRIGERATION IN DEEP MINES TO AID WORKERS

Artificial refrigeration, which is bringing greater comfort to thousands of persons in homes and public buildings each year, is to be extended for the benefit of the workers in deep mines, it was announced recently. Ventilating engineers point out that the present depth limit for successful operations in metal mines is approximately 8,000 feet, as proper atmospheric conditions cannot be maintained at greater depths. Air, circulated from the surface to the deep workings, is heated by compression and by the heat of the rocks which is given off in increasing quantity as the depth increases. By placing specially designed refrigerating and air-treating units underground, near the workings, to cool the air and rob it of dampness, mining can be carried on at greater depths, it is predicted. Interesting tests have shown that when the temperature is over ninety-four degrees Fahrenheit, the wearing of clothing is beneficial, as it promotes cooling through greater evaporation, and is therefore recommended to workers in deep mines.

Fighting Mysterious

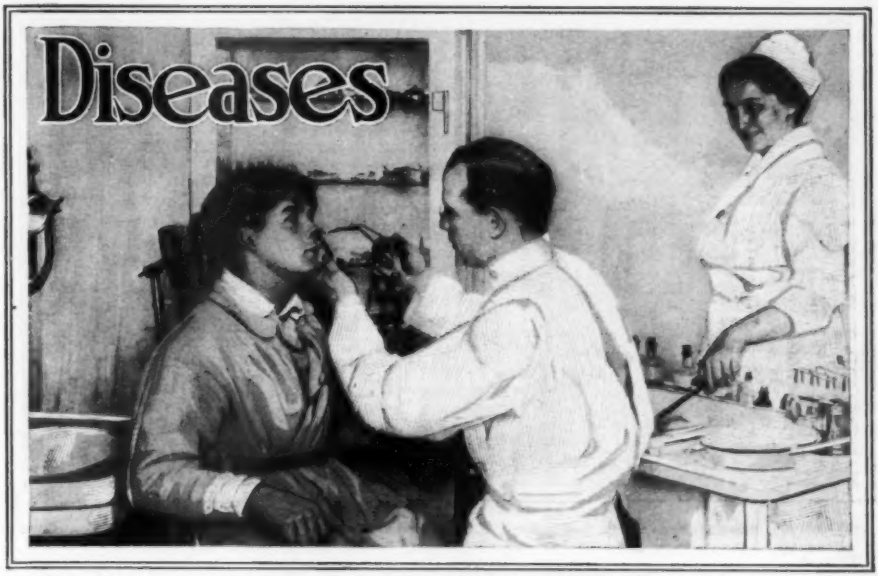
The Quarantine Officer Boarding a Ship Via a Rope Ladder to Inspect Passengers and Crew

JUST a short time ago, an ailment which science is unable to classify snuffed out the life of Dr. Joseph Goldberger, of the public health service, whose army of research workers aims to control the rise and spread of harmful diseases.

Those high up in the medical world are saying today that Doctor Goldberger's career represented in the very highest sense the adventure and extreme danger that is typical of the everyday existence of his colleagues. Continually they are called upon to handle germs of strange maladies that threaten the lives of men—maladies such as pellagra, a nutritional disease that wiped out hundreds of thousands in America before Doctor Goldberger found the remedy; Rocky Mountain spotted fever, which has killed seven scientists of the service; Malta fever, which is spread by human contact with infected goat's milk, a disease which Dr. Charles Nicolle, recipient of the 1928 Nobel prize for medicine, says is the malady of the future; tularæmia, rare and serious ailment passed on to man by wild rabbits, flies and ticks; loathsome leprosy, age-old scourge of mankind, and our familiar "flu."

Not all these diseases are strikingly fatal, at least in an immediate sense, yet each one possesses characteristics so mysterious as to puzzle the best-trained minds of the medical fraternity. Considering the wealth of Doctor Goldberger's experience, which brought him into intimate contact with other dangerous maladies, such as yellow fever, typhus, and the peculiar, bone-breaking dengue fever, the wonder is that he was able to survive so long as he did. Indeed, long before his recent fatal attack, which certain experts believe may have been an ailment akin to pellagra, Doctor Goldberger three times fell a victim to diseases upon which he was conducting experiments.

Probably the most mysterious thing about pellagra, an ailment upon which Doctor Goldberger worked fourteen years, is the fact that, although it evinces certain prominent characteristics of anæmia, or a distinctly undernourished condition of the body, it has been hard to diagnose. Pellagra has been known for almost 200 years, notably in Spain, northern Italy, Egypt and the Balkans, but it was not discovered in America until 1908. Immediately the American health experts set out to find a possible cure, working on the already established premise that some sort of faulty diet mixture was the cause. But it was not until a few years ago that Doctor Goldberger met with success. Having been assigned to study pellagra in the south, he managed to gain permission to use human subjects for his tests. This done, he put the subjects, a group of Mis-



Treating a Patient at the United States Marine Hospital, at Stapleton, N. Y.; Marine Hospitals for the Care of Sailors Are Operated at Many Points on the Coast and Great Lakes

sissippi convicts, on a special diet of cornbread and bacon, designed to produce the disease. Successful here, not long afterward Doctor Goldberger discovered his world-famous cure in the form of the vitamine PP, or pellagra preventive, a substance obtainable in ordinary dried yeast.

Rocky Mountain spotted fever is far more fatal than pellagra. In fact, the patient hasn't a chance to survive unless he is so fortunate as to rally after surviving seven days' exposure to the disease. So we are told by Dr. R. R. Spencer of the service, and he should know, since he is regarded generally as having done more important research in the disease than probably any person now alive.

Strange to say, the virulence of this ailment varies sharply according to the locality. In certain sections of Montana, for instance, the mortality has been eighty to ninety per cent, while in a near-by state the death rate is considerably less. As to how the disease manifests itself upon the human body, even those of us who have had smallpox may well afford to smile with relief rather than gamble with the grim reaper by risking getting an infection accompanied by severe chills and fever and characterized by a disagreeable, turkey-red rash that covers the victim from head to foot.

It was Doctor Spencer who helped develop a preventive for this terrible malady a few years ago, and to say that he has risked his life in this connection is by no means overstating the facts. Even today there is no remedy for spotted fever, so if a man contracts it he goes to bed and prays that in seven days' time he'll still be alive.

In explaining how he was able to devise his preventive, now widely used as a vaccine, Doctor Spencer tells an absorbing story. Working with R. R. Parker, special entomological (bug) expert of the service, he paid particular attention to the behavior of the malady on small rodents to whom it is spread by ticks which likewise bite men. Since one attack of the disease apparently develops immunity, the possibility of a vaccine suggested itself. However, right here a difficulty presented itself, for it was found that the virus could not be cultivated in a test tube.

Therefore the scientists, noticing that the virus was developed and kept alive in the bodies of the ticks that transmit the disease, decided to make artificial test tubes of the wee crawlers and prepare the

The Artist's Room at the Hygienic Laboratory; Uncle Sam's Doctors Not Only Treat the Sick but Contribute Largely to the Advancement of Surgical and Medical Knowledge

vaccine from them. The best procedure was to let the ticks feed upon infected guinea pigs until they had become thoroughly infected themselves. Whereupon, when tests showed the virus to be in highly concentrated form, the crawlers were ground up, and an emulsion prepared that would serve as a vaccine.

Tests on animals indicated that the vaccine might work, and now came the most important question of all, how would it affect human beings? Certainly the investigators were not going to risk the lives of outsiders, so Doctor Spencer, without the slightest hesitation, first of all tried out the new preventive on himself. Fortunately, he suffered no ill effects, and six months later his colleagues followed suit.

Since Doctor Spencer's gamble with death, there have been some highly interesting developments. Within the past few years, nearly 4,500 people in the Rocky Mountain district, mostly sheepherders, who are exposed to the disease very frequently, have been vaccinated. Moreover, eight cases have appeared in the laboratories of the health service among scientists that were vaccinated, and only one died. And there is furthermore the fact that in a certain area in western Montana, there were recently, during a like period, twelve cases among vaccinated persons that resulted in but one fatality.

The four experts of the service who lately have been suffering from Malta, or undulant, fever, are Miss Alice C. Evans, Dr. G. C. Lake, B. S. Stockrider and Dr. Edward Francis. Not one of them has the slightest idea as to just how or when the ailment first overtook them. Miss Evans is one of the best-known bacteriologists in the country, mainly through her pioneer work in connection with the puzzling disease. Ever since 1922, she has suffered off and on from its ravages, which sometimes resemble typhoid fever and, upon other occasions, rheumatism.

It was Miss Evans who, in 1918, made the important discovery that there is a very close relationship between the organism that causes Malta fever and that which causes a serious and contagious cattle disease. This finding paved the way for another notable discovery, made in 1922, to the effect that people drinking milk from infected cows might contract the ailment, which fact no doubt prompted the statement by Doctor Nicolle, recent Nobel prize winner, who says that it is high time modern scientists began to concentrate on the malady to the end of preventing it from becoming a serious menace.

Statistics sound dryly technical to most

of us. But the way they are used by government experts is a matter of utmost importance. When a country-wide epidemic study is planned, it requires the services of an efficient staff of statisticians, clerks and operatives whose job it is to analyze and draw conclusions from a great mass of information gathered each year. Facts must be marshaled with utmost care so that the country's health may be preserved in the best manner possible.

The service utilizes many unique instruments. One of the latest is the daylight recorder, designed to measure the exact extent of a building's contamination by city smoke, particularly that coming from the chimneys of private houses and industrial plants. Recently James E. Ives, government physicist, made tests with the instrument in New York City. It may be described as consisting of a photoelectric cell and what is known as a recording potentiometer. One such cell was stationed on the roof of a hospital in lower Manhattan, where the air is usually very dense, while the potentiometer was placed at a convenient point within the building. Another complete apparatus was installed in lower New York bay, where the air is ordinarily clear.

Dust-Counting Apparatus, Top; Daylight Recorder, Center, and a Bacteriological Laboratory in One of the U. S. Hospitals

Both cells were installed on platforms so located that no shadows were cast upon them at any time of the day. When light falls upon the cell, electrons, or negative charges of electricity, are discharged, the number of electrons thus projected increasing in proportion to the cell's total illumination. The potentiometer is the record-making part of the device. It is box-shaped and automatically makes a graph on paper. In the above test, the fact was disclosed that there is no definite relation between inside and total outside illumination, and, furthermore, that it is the ultraviolet component in sunshine which is responsible for the beneficial effects of the sun on man.

Another novel device tested by the service is the dust recorder, used to help gain

Photos Courtesy U. S. Public Health Service

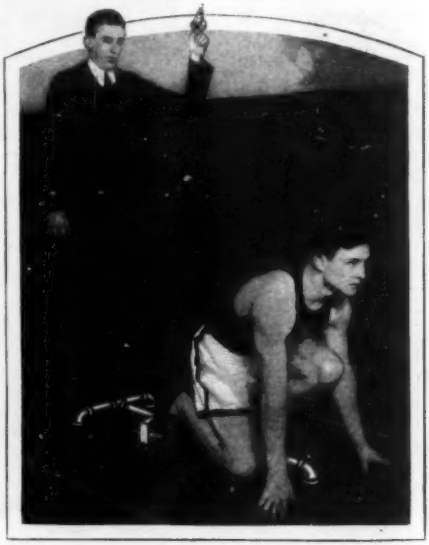
Statistics on Perplexing Diseases Are Tabulated in This Department as Part of the Government's Efforts to Locate Affected Areas and Conquer New Ailments as They Appear

evidence of the pernicious effects of certain kinds of dusts upon the health of persons employed in certain industries. The dust counter consists of a glass tube, a non-collapsible rubber tube and a foot pump, besides a fine screen that prevents the dust from entering the pump, thus setting the dust apart for the critical examination of the expert. The dust samples may be preserved indefinitely before analysis.

All modern nations recognize the need of national quarantine regulations. The health service administers the quarantine at all ports of the United States by exercising two major functions, prevention of the entrance of diseases from foreign countries and medical inspection of aliens applying for admission. The service has jurisdiction over all ships and persons coming into our ports from abroad.

STARTING FRAME FOR RACERS SAVES DIGGING HOLES

To save digging holes in the track for bracing the toes of sprinters, a starting frame, consisting of a small metal pipe with two adjustable wooden pedals for the racers' spiked shoes, has been introduced. The frame is set simply by stepping on it, and the starter is suitable for use on any track.



Starting Frame in Use; It Is Set by Stepping on Bracket at the Rear, and Toe Plate Is Adjustable

FOUR LITTLE-KNOWN SUBJECTS OF UNCLE SAM

On Barro-Colorado, in Gatun Lake, Canal Zone, the U. S. Has a Strange Jungle Wild-Life Preserve; Above Is a Two-Toed Sloth Hanging, as Is Its Custom, Upside Down

Derby's Wabbly Opossum Uses His Own Tail for a Ladder and Hangs by It in His Sleep

The Digging of the Canal and Flooding of the Gatun Basin Cut Off All Hill Tops from the Mainland, and, as a Result, Jungle Types Are Preserved in the Unique Condition Found by the Crane-Field Museum Expedition When These Pictures Were Taken; at the Left, Karl P. Schmidt Is Holding a Live Iguana, a Lizard That Runs Mostly to Tail, and, Above, an Ant Eater Has Curled Up in the Fork of a Tree to Sleep Off a Full Meal; Precautions Are Being Taken to Protect the Wild Life on the Islands of the Artificial Lake

Railroad Employes at a Session of the Traveling School, and Close Views of Groups in Special Instruction

RAILROAD SCHOOL ON WHEELS REDUCES ACCIDENTS

Those of the Great Northern railroad's 30,000 employes who have anything to do with the operation of trains or maintenance of equipment and tracks, attend school in a rolling college, five steel cars equipped with classrooms, a laboratory and a motion-picture theater. A staff of instructors and an examining board have living quarters on the train. Particular emphasis is placed on safety-first lessons. The movies are used for this, and the theater car is said to be the only one of its kind in the world. The floor is inclined as in a stationary theater, the projection booth is at the rear and music is furnished by radio. In the two cars equipped with the mechanical displays, working models of various railroad appliances are employed to show those who have to operate the real equipment how the machines work. Classes are instructed in fuel conservation and care of accessories. The board of examiners is made up of seasoned employes from the groups which are required to take the tests to determine if the workers have the knowledge they should possess for their tasks, and if they are always mentally alert and "on their toes."

AIRCRAFT TO MAKE MALARIA FIGHT IN NICARAGUA

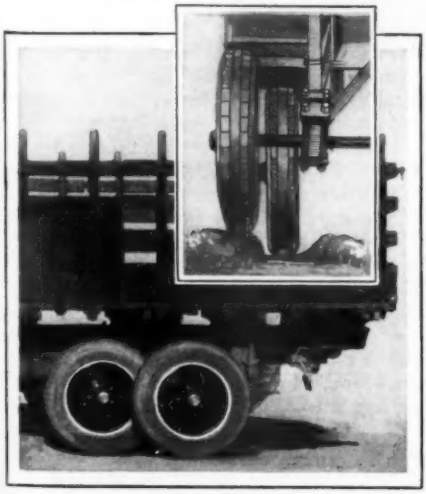
Airplanes will be enlisted in the health service, if plans for combating malaria by killing mosquitoes with poisons sprayed from the air, materialize. A mixture of paris green, capable of penetrating the densest vegetation and reaching the breeding places of the insect carriers of the disease is to be used, it was announced. Planes operated by the United States marine corps have already performed this work successfully in and around Managua, Nicaragua. There was a marked decrease in the number of new cases of malaria after the planes had made a few spraying trips. The mixture was released from a height of 100 feet through a special apparatus. Three dustings were found sufficient to clear an area, and additional visits were made at two-week intervals.

HEAT BOMBS FOR AIR RAIDS TO MELT CITIES

Experts who have declared that adequate defense from air raids will be impossible in the next war, receive support in the announcement of a powerful heat bomb which can destroy, not only metal, but even cement and granite. It is of an "electron incendiary" type and is said to develop 3,000 degrees of heat. Each bomb weighs only a little more than two pounds so that a large plane could carry 1,000 of them. A fleet of 100 planes, so equipped, could sow destruction over a city in a few moments, spreading flames that would entirely destroy it, experts believe.

EXTRA WHEELS ON FORD TRUCK DOUBLE ITS CAPACITY

The carrying capacity of the Ford "AA" truck is said to be doubled by adding two wheels which run on the outside and closely behind the originals, to which they are connected by a flexible unit that is said to equalize the road pressure on all wheels under any road and load conditions. Steering is made easy and the turning radius of the truck is not increased. One user of the wheels applied them to a trailer on which he is able to haul three automobiles at one time.



Photograph of the Wheels as Installed, and Drawing to Show How They Function

French Policeman with His Armor Equipment; It Is Carried in a Folding Kit When Not in Use

STEEL ARMOR IN FOLDING KIT PROTECTS POLICEMEN

Plain-clothes policemen in Paris are being equipped with a kit of folding armor for protection against bandits. The outfit consists of a steel headgear and a sheet of steel that serves as a shield in case of a battle. In addition, they wear bullet-proof vests.

MOVIES OF CITY UNDER THE SEA TO AID HISTORIANS

Motion-picture cameramen, working under the sea, recently have made valuable historical films of the submerged city of Jamestown, once the chief settlement on the island of St. Nevis, in the West Indies. The remains of the old city are to be seen under the water near the shore. On April 30, 1680, the town was destroyed by an earthquake and slipped into the ocean, carrying with it most of the inhabitants.

Iron Men of the

Crews of the Lighthouse Provision Boats Have More Than Their Share of Thrills during Rough Weather

HOW would you like to be a lighthouse keeper in a remote spot during a terrific hurricane? When the wind is raging furiously at a velocity of over 150 miles an hour, while the roof of your only dwelling place is being blown away, and all electric wires and poles in your immediate vicinity are being forced down and broken?

Such notations appear frequently upon the records of the United States lighthouse service, whereas there is oftentimes the added news: "The near-by radio station is out of commission due to lack of power and there are no telegraph communications."

One might well suppose that, during such periods, Uncle Sam's guardians of our coasts would be justified in seeking safety for themselves, but there seems to be no instance of such action. On the contrary, the "Iron Men of the Lighthouse Service," as they are known, have established an enviable record of remaining on the job at all times.

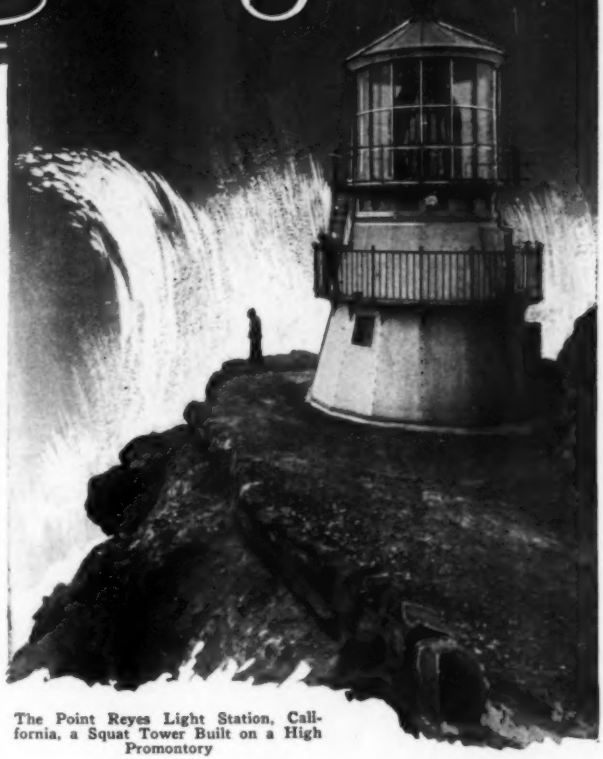
Particularly striking instances of this sort took place during the great hurricane of last September, which on the thirteenth of the month struck Porto Rico and the Virgin islands, causing great property damage and loss of life. At San Juan, Porto Rico, the hurricane smashed and battered away until it had blown off the roof of the lighthouse quarters, extinguished countless lights and damaged a great portion of the electrical apparatus, causing a total loss of about $63,000. Yet J. R. Monteiro, the superintendent, stayed at his post with six helpers until the fury of the storm had passed, as did also the men in charge at Key West and Jupiter Inlet stations, Florida, where the damage

Lighthouse Service

in each instance approximated $25,000.

Time and again upon occasions of national disasters, the men of the lighthouse service have been on hand to aid materially in rescue operations. During the Mississippi flood of 1927, these tireless fellows worked night and day under the personal direction of Herbert Hoover, then secretary of commerce. The lightkeepers made a notable record by maintaining the regular aids to navigation under the greatest of difficulties and by checking up on the anticipated flood heights.

The same kind of unselfish aid was given when the great St. Francis dam in California broke a year ago. A notable instance took place on the evening of March 12, 1928, when Francis A. O'Leary, inspector of airways construction in the region, happened to be driving his car in the vicinity. All at once he saw what seemed at first glance to be a heavy valley fog in the Santa Paula river bed. Investigating, he soon noticed a raging torrent which appeared like a wave twelve feet high crossing a highway at right angles to him. Above the deafening noise of the waters he heard a voice crying for help, and when he headed in the direction he found a man and woman struggling for a foothold. They had escaped the first great rush of water but now were caught in the overflow. O'Leary somehow contrived to help the couple to dry land, then into his auto, and carry them to safety.



The Point Reyes Light Station, California, a Squat Tower Built on a High Promontory

Aside from unusual natural disasters, the lighthouse men are called upon continually, during their daily work, to cope with the severest kind of weather conditions. Particularly is this true in winter time at stations along the Great Lakes where ice mountains arise almost overnight. Not so long ago at the Ashtabula lighthouse, on Lake Erie, located on a breakwater pierhead in an extremely exposed position about a half mile off shore, a gale from the westward suddenly arose and lasted three days with the result that, due to the open water and the force of the wind, the sea and spray froze to the light-

In Northern Waters, Lighthouse Keepers Must Fight Ice; Bottom, Examining a Gas and Whistling Buoy in New York Bay in Winter

house crib and buildings, completely incasing the structure in heavy ice.

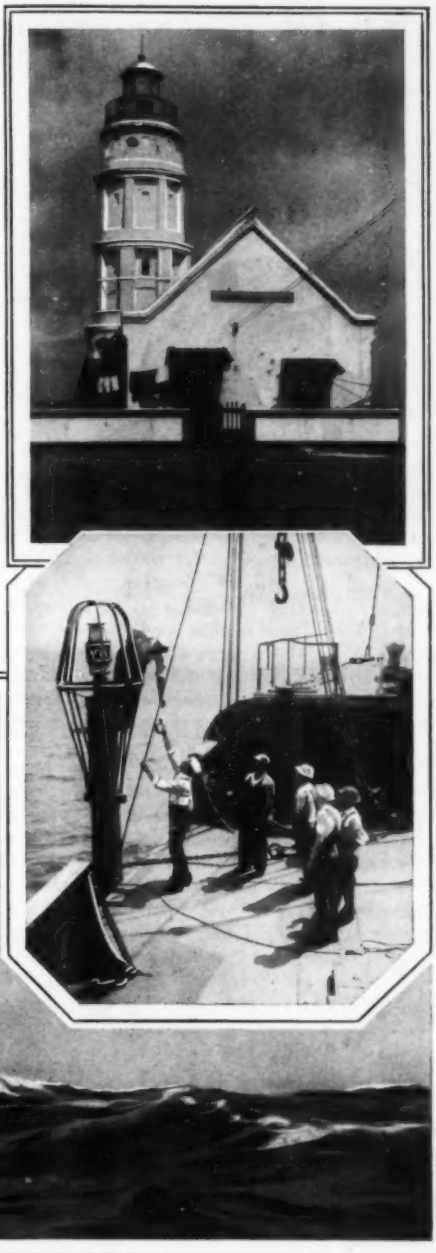
Now the two keepers were storm-bound, unable to reach shore. However, at the end of the gale, the other two keepers, located ashore, went to their aid, though to do so they had to travel more than two miles along a treacherous course. Upon arriving at the station, they hardly could recognize it with its thick ice coating. In order to establish communication with the outside world, it was found necessary to thaw open the entrance door on the east side and literally dig through the ice with pick and crowbar for a distance of forty feet before a ladder could be placed on the breakwater.

Some of the more recent rescues effected by the Iron Men are classic examples of heroism. On a certain cold winter evening a young man fell over a cliff above Sea Lion Cave, two miles from Heceta Head light station in Oregon, eighty feet to the rocks below, and was believed to be seriously injured, if not dead. At six o'clock the lighthouse officials were notified. Their only means of illumination were a lantern, two flashlights and one tiny carbide light. Yet, for well

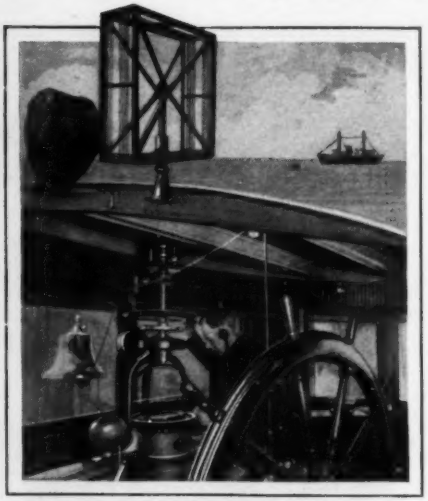
over an hour, the lighthouse keeper, his assistant and two other men risked their lives by traversing the side of a cliff for about 1,500 feet on a narrow trail, between eight and twelve inches wide. And all the while their distance from the treacherous surf and rocks below was close to 300 feet.

Nevertheless the men somehow managed to keep their balance and when they had reached a point just above the injured man, they lowered a rope. First of all, one of the lighthouse officials went down, and shortly thereafter the other rescuers followed. It did not take them long to discover that the victim was seriously injured, having a compound fracture of the leg. Since there was no doctor anywhere near the immediate vicinity, one of the men set the boy's leg. Whereupon the youth was lashed to a board and taken up the cliff, a feat that required two hours.

Countless other instances, both in the regular line of duty and outside it, might be cited. Many are the occasions when young boys, intent on swimming or fishing, venture far out into a bay and are rescued only by reason of the vigilance of



The Farola, Manila Harbor, Built in 1846, Is the Oldest Lighthouse in the Philippines; Bottom, Breaking Waves Dashing against Minots Ledge Lighthouse; Inset, a Gas Buoy



Using the Radio Compass to Obtain a Ship's Bearings from Signals Sent from Shore

a lighthouse keeper. Or perhaps a shipwrecked tug will sink in the midst of a storm, an automobile driver, temporarily blinded by extreme fog or darkness, will plunge into the water; and in these days, when forced landings in amphibian planes occur, there are frequent occasions when an officer of a lighthouse vessel gives assistance to the flyers.

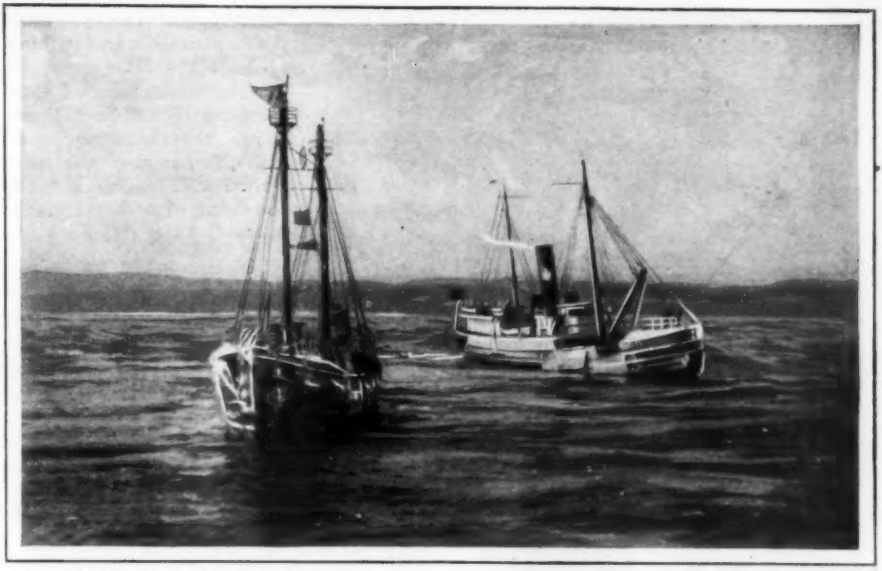
Record-breaking airplane flights have been aided materially by the towering guardian lights of our shores. Fresh in memory is the first flight by plane between San Francisco and Hawaii, accomplished not so long ago by Lieutenants Maitland and Hegenberger. At dead of night, the two army flyers might easily have passed the Hawaiian islands entirely, had they not seen from their lofty heights the welcome flashes of Kilauea point light. But under the actual circumstances, airmen were able to pick up the light from a distance of about ninety miles, soon recognizing its source as one of Uncle Sam's lighthouses.

May be it's not quite fair to mention the almost breath-taking accomplishments of a single individual in the service, since there have been so many instances of heroic deeds. However, it is highly interesting to note that this particular individual has the following seven outstanding rescues to his credit: Back in 1914, he ran a line through the surf to a drifting lightship; two years later, he rescued a man from drowning; three years after that, he towed a disabled steamer to safe anchorage; a year more, and he helped float a grounded transport; three more years, and he helped tow a disabled tugboat and dredge from a highly dangerous harbor position; a year later he rescued, at dead of night in rough sea, two fishermen who were physically exhausted and without provisions; and a few years ago rescued the entire crew of a coast-guard patrol boat.

But, of course, hazardous rescue work is only one phase of the everyday routine of the lighthouse men. A search for a buoy that simply won't stay put sometimes contains all the essential characteristics of the game known as "Hare and Hounds," except, of course, that there's a bit more territory to be examined on the surface of the oceans. Lighthouse construction of today is, in general, far different in principle from what it was in the not so remote past. Rarely, these days, do we see the towering structure that was so common yesterday. Which is partly because the earlier lighthouses were usually erected to mark prominent headlands or landfall points where range of visibility was the fundamental feature and the height of the tower increased its visibility range. Then again, the lighthouse of the earlier days was also used as a day mark, a fact toward which its height contributed.

At the present time, most prominent headlands have been marked for many a day, so modern-day lighthouse engineering is devoted in a large measure to marking out with greater preciseness the specific dangers and the courses of channels. For these purposes small structures of lesser visibility range are suitable. The increased power of illuminants as used today is another very good reason why structures of less height may ordinarily be used to great advantage. However, in some localities the conditions of former days still prevail and a skyscraping type of lighthouse building is occasionally built In this connection an outstanding example is the lofty one on Navassa island in the West Indies. Built in 1917, it measures 162 feet in height.

Still another marked departure from the



Photos Courtesy U. S. Lighthouse Service

The Lightship "Scotland," One of the Most Famous in the Atlantic, with the Lighthouse Service Tender "Tulip" alongside, to Deliver the Regular Quota of Supplies

old-time lighthouse system is the emphasis today on what is known as a "light vessel." All in all there are about sixty in commission and they are employed usually for marking danger zones at sea: entrances to harbors; important points in the course of vessels; in short, where a lighthouse would not be feasible or economical.

These ships are distinguishable in the daytime by their unusual shape and rig, including usually some form of gallery at the mastheads, and by their characteristic painting and lettering. The hull often is painted red or straw color, but other colors or combinations are also employed.

SYNTHETIC BENZINE PROCESS TO AID GERMANY

German chemists are reported to have developed a process for making synthetic benzine to meet the great demand for motor fuel and the limited supplies of natural oil. Tests have shown that the synthetic product can be made at this plant in quantities up to 250,000 tons a year or approximately one-fourth of the entire consumption in Germany. There are now more than 1,000,000 automobiles in Germany and the fuel question is one to which the chemists are directing much attention.

STREET NAMES ON CURBSTONE MORE EASILY SEEN

Street names, painted on the curbstone, appeared in Washington, D. C., recently. The characters are easily renewed when they become dull, and the plan eliminates the need of posts or tags.

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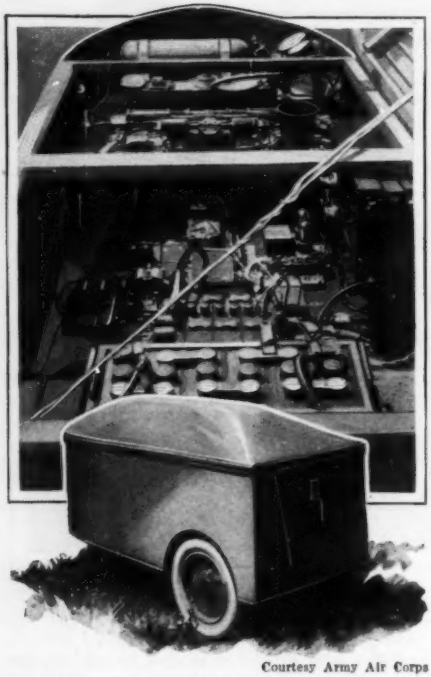
Street Name Painted on Curbstone Where It Can Be Renewed Easily and Seen at a Distance



Courtesy Army Air Corps

Close View of the Radio-Controlled Tank and of Its Interior Equipment

WAR TANK IS RUN BY RADIO FROM MOVING PLANE

Flying at an altitude of 2,000 feet, an airplane operated the controls of a tank or miniature automobile on the ground—started, directed and stopped it—during an interesting test at Wright field, Dayton, Ohio, recently. The tank, without any other means of guidance, responded to radio impulses transmitted from the plane. Guns were fired and horns were blown by the same impulses, all radiated from a height of 2,000 feet. The car was shrouded in white to make it more clearly visible to the pilot. Aerial torpedoes and armored tanks may be guided by such means in the war of the future, the experiment suggests, and battleships, so controlled, could enter a naval engagement with heavy charges of explosives without a crew. Such vessels, loaded with dynamite, could be sent into enemy waters and exploded by radio. The United States navy and other naval forces have operated ships without a person aboard, the controls being actuated by radio from another ship. The radio-controlled torpedo boat, developed by John Hays Hammond, Jr., is also familiar to those who have followed this phase of the growth of radio. A railroad company has experimentally operated a train with the hands of the engineer off the throttle, the engine obeying the unseen commands of a distant radio set. Miniature trains have also been run by this method.

EDITING OF HOME MOVIES EASY WITH SIMPLE SET

Added enjoyment in taking your own motion pictures is afforded by a simple outfit for editing the films. It permits inserting titles, "trick shots," corrections and other "extras" that feature the usual commercial film. It also simplifies the task of arranging the pictures in their proper order. The set consists of a viewer unit, simply a magnifying eyepiece set at a convenient level, a splicer block for cutting and splicing the film, and a rewinding reel, geared for rapid work. To edit a film, it is threaded through a channel on the underside of the eyepiece and attached to an empty reel. An extension cord is plugged into a socket to furnish light for the viewer. The magnifying glass enlarges the image to nine times its actual area and a prism causes the picture to appear right side up. When a section is to be cut out, the film is drawn from the

Using the Editing Outfit for Movies Taken at Home; the Magnifier Enlarges the Image Nine Times

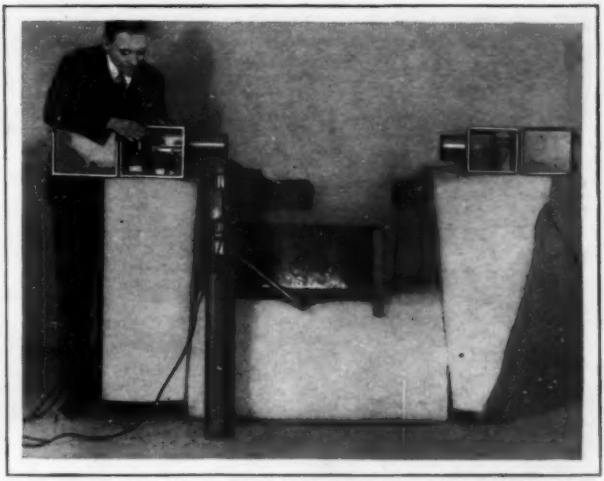
channel upon the splicer block, the cutting is done, and the film is spliced again with cement that is kept in a bottle firmly held in a socket.

HEAVIER FUEL TO AID AVIATION

Use of heavier fuels in increasing quantities for automobiles and airplanes was forecast recently by a well-known petroleum engineer. He pointed out that an oil-burning Diesel engine for aircraft, which weighs but three pounds per horsepower, already has been developed, and that first tests with it indicate it will prove a success. He asserted that more fuel oil is being used every day, despite the popular idea that gasoline is the principal product from the distillation of petroleum. This development in fuels will be followed by changes in the design of internal-combustion engines, he predicted, and declared that one of the needs of today is more research in fuels to realize greater motor efficiency.

STEEL ARMOR FOR CONCRETE HELPS IMPROVE FLOORS

To strengthen concrete floors and simplify their construction, a reinforcing material in the form of a steel matting has been introduced. It consists of a number of steel strips which, when placed together, form a series of separate rectangles of proper size to meet the conditions under which the floor must be used. The strips are set on edge and are connected by means of tie-rods. This steel matting, filled with concrete, prevents the formation of cracks and other irregularities, and distributes stresses more evenly.



Testing Outfit Used to Demonstrate How Photo-Electric Cell Was Used to Extinguish a Fire; Smoke Caused It to Function

ELECTRIC "EYE" SEES SMOKE AND PUTS OUT FIRE

Further possibilities of the photo-electric cell, the magic "eye" that has been used to sort cigars, match colors, count automobiles and perform other tasks, were demonstrated in New York recently. A lighted match was tossed into a pan containing gasoline. The puff of smoke, drifting in front of the photo-electric cell, which is extremely sensitive to changes in the intensity of light, caused it to set up an electric impulse. This, in turn, released carbon dioxide from a container and the gas quickly smothered the fire. At the same demonstration, the eye counted the guests as they passed through a slender beam of light.

MYSTERY BIRDS LAND ON SHIP MANY MILES AT SEA

British naturalists have been faced with a problem in attempting to identify three birds which alighted on the rigging of a steamer 500 miles off the American coast, were captured, and are now on display at the Crystal Palace in London. They are about the same size as parrots, grayish-blue in color and white-breasted. At last reports, no one had been able to identify them positively.

Hunters of the H. A. and Sidney Snow Arctic Expedition with Walrus Shot in Bering Sea, alongside Their Schooner "Herman"; the Snows Solved the Herald Island Mystery

By ALFRED ALBELLI

WHEN Dr. Fridtjof Nansen, the arctic explorer, who is now sixty-seven years old, returns to the north-polar haunts of his youth next year, he is going to explore the mysteries of a sea which science still knows little about.

In April, 1930, Doctor Nansen will be passing over the north-polar sea in the "Graf Zeppelin," the dirigible which Hugo Eckener brought to America in a trans-atlantic flight. Eckener will again be in command of the "Graf Zeppelin" as she sets out on the polar flight.

There are secrets locked in the depths, and the surface also, of the north-polar sea which Doctor Nansen wants to learn. He is confident that in the region still set down by science as "the Unknown" there are islands to be discovered.

As he passes through that unknown sector, Doctor Nansen expects to make a thorough study of the body of water there as well as of the islands themselves. He will seek to know what nature of life exists on those hitherto virgin islands.

But Doctor Nansen's expedition primarily is a mission of science, not one of discovery. The latter will be subordinate to the amassing of scientific data in the north-polar area.

The veteran arctic explorer—he has led five scientific expeditions through the white wilderness—is returning to the land of the midnight sun after a varied career in international diplomacy. He was Norway's first minister to England and represented his country at the League of Nations. His first journey into the polar periphery was at the age of twenty as one of the crew of a sealing vessel.

• Doctor Nansen's "Graf Zeppelin" expedition will be to determine various scientific issues which indirectly will have immense commercial value in the future, affecting navigation rather than fisheries.

"We are going to attempt to unravel the problem of the depth of the north-polar sea," he said. "We want to discover the fitness of the topography on the surface of the water, and beneath it, so to speak.

"By acquainting ourselves with the re-

of the Polar Sea

In 1913 the "Karluk," One of Vilhjalmur Stefansson's Polar Ships, Was Crushed in the Ice; Four Men Reached Herald Island and Perished There; Their Fate Remained a Mystery Until the Snow Brothers Three Years Ago Reached the Camp and Found the Bodies; Top, a Herd of Walrus on the Ice, with the "Herman" in the Distance; Left, a Dead Polar Bear on Deck, and, Right, One That Was Lassoed and Caught Alive; Below, the Herald Island Mystery Solved

lief conditions of the surface of the water," he continued, "we can establish a basis for future operations. We want to decide the boundaries of that deep ocean, where the converging continents of Asia, North America and Europe are really marked. We want to record the precise extent of the continental shelf.

"Also we want to get records of atmospheric conditions, the temperature under water, samples of that water in various regions and the ice movements. I am of the opinion that the climatic conditions of the universe are deep-rooted in the weather situation prevailing in the polar realm. The commercial value of our expedition will be realized in the end from deductions possible from our figures which will allow navigators to calculate the state of the atmosphere for sea and air travel at all times.

"We are going to spend exactly three months in this polar flight. The greater part of our work will be in connection with the soundings.

"Sounding is probably one of the most fascinating endeavors of the polar explorer. The computations may be made either by using an explosive or a metal plate, usually a gong.

"On the first sounding, which means either the explosion or the clanging of a gong, you can get a figure within a few feet of the actual depth. A second sounding will practically give you an accurate figure. Strong wind currents are apt to interfere with the sounding work. A special gong, called an echo lead, has been worked out by a German inventor for our journey, to cope with any interferences from the elements.

"In gathering sounding computations, one must reckon with the temperature, the salinity and speed. Those are the salient points. As for salinity and temperature in the particular regions we are heading for, I did a great deal of the work in 1912 on my expedition with my yacht 'Veslemoey.' We explored the water and the currents from the Atlantic ocean, and the drift of the ice. But, of course, there is still the unknown region to be taken in.

"My sounding experiences in the arctic go back to 1893-96, when I went there with the 'Fram.' It was then that I actually established the fact for the first time in history that the north-polar sea existed as one large body of water. I allowed my ship to become icebound; then, when the drift began, we sailed right along with it. Of course we never knew when we would be dropped off into eternity. We averaged one mile in twenty-four hours on this journey.

"But now on my return, I expect to do more in three months with the 'Graf Zeppelin' than I accomplished in three years with the 'Fram.' I will have with me not only all the data I gathered in former years, but also many new instruments to make my work more efficient. Many of the instruments I have invented myself.

"We are not blind to the fact that air travel over the pole is a hazardous undertaking. There will be about forty persons on the journey, twelve of them scientists.

"There will be special sledge equipment on the airship with abundant provisions as a safeguard in the event of some accident. Should the necessity to come down arise, we are not going to have to worry. The distance to the nearest known coast,

Eskimo Hunters from the "Herman" Chasing a Polar Bear to Head Him Off Until the Ship Can Come Up Close Enough for a Lasso to Be Dropped over His Neck

Photos Courtesy Fox Films

Whale Hunting off the Alaskan Peninsula; One of the Adventures of the "Herman" Was an Old-Time Whaling Expedition, with Hand Harpoons Instead of the Modern Harpoon Gun

from wherever we happen to be in the unknown region will never be so great that the 'Zeppelin' could not get near it in a few hours before the mobility of the ship would be completely spent.

"The bases for our expedition will be in Nome and Leningrad. We will travel from the Murman coast, over Franz Joseph Land, through the region about the north pole, on through the regions north of the North American archipelago toward Alaska, and thence to Nome in Alaska. From Nome the return trip will be nearer the Siberian side of the unknown region.

"Over this route we do not have hopes of discovering much of marine life. There is scarcely any extant. However, we are going to penetrate the secret of this barrenness too. Since the region is mostly covered with ice, the chemical properties of light are absorbed before they can reach the water. And where there is no light there can be no life of either the plant or animal variety.

"In case we do discover land or islands on our course, it is going to be simple for us to make an accurate photographic survey while flying over the section. The dirigible is ideal for surveying purposes. Underneath, fore and aft, will be suspended two cameras in horizontal positions. Photographs will be taken simultaneously by these cameras wherever we choose to go. We have high expectations of solving the north-polar sea riddle."

FUTURE SUPPLY OF METALS PERILED BY BIG DEMAND

Nature's mineral cupboards are running low in some sections of the world, and experts are wondering if our present efficient applications of science and technology can keep pace with the demands of coming generations. In America, according to D. F. Hewett, of the United States geological survey, vast resources of iron, copper, lead, zinc, silver and gold have been attacked so vigorously that many districts are approaching exhaustion, and production is being kept alive only by the application of refining methods to low-grade ores. The digging of deeper shafts is another indication of the tremendous drains that are being made on the supply of metals. In Europe, there is a trend toward agreements to control such metals as iron and steel, mercury, aluminum, lead and copper.

Aviator's Face Mask with Its Stiff Nosepiece, Which Allows Free Breathing Regardless of Wind Pressure

AVIATOR'S FACE MASK PERMITS FREE BREATHING

Fastened to the helmet by snaps, an aviator's cold-weather face mask, devised by a California air-mail pilot, has a stiff leather nosepiece. This retains its shape in all wind pressures and hence does not obstruct the breathing.

NICARAGUA CANAL TO SAVE TIME IN SHIPPING

Interest in a proposed canal across Nicaragua has been revived with a suggestion that surveys be made as soon as practical to more definitely determine what the costs would be and what results would accrue. The channel would materially reduce the shipping time between Atlantic and Pacific ports in this country.

MOVIES IN THREE DIMENSIONS BY NEW SCREEN

Motion pictures that seem to possess depth from any position, a true stereoscopic effect, and that do not require the use of special viewing apparatus, are now possible. The method is essentially that followed in producing still pictures of stereoscopic nature. The screen is of translucent material and just in front and behind it are vertical gratings with wide opaque strips separated by much narrower transparent areas. A large number of motion-picture machines project upon the screen from a number of films that were made with many cameras placed on all sides of the subject. The result is that, no matter where the spectator sits so long as he is in front of the screen, he sees the picture in relief. Because of the gratings, one eye sees a picture made with one camera and the other the next, made with another camera. This produces the stereoscopic effect.

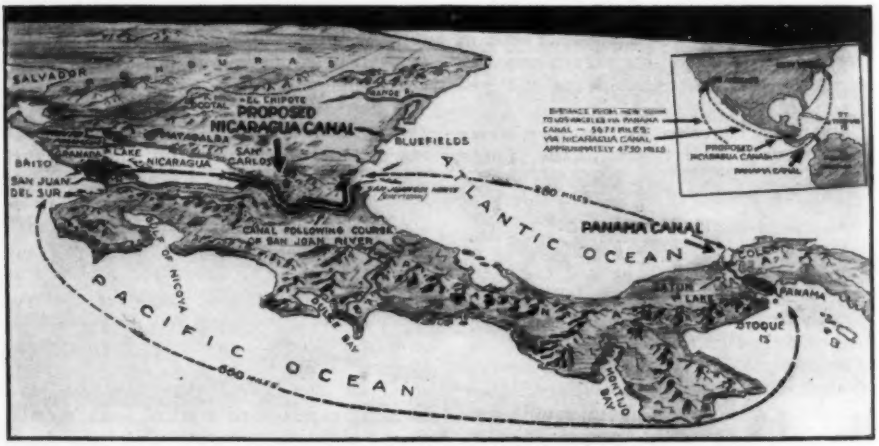


Diagram of the Proposed Nicaragua Canal Showing Routes and Distances as Compared with Those That Now Have to Be Traveled When Using the Panama Canal

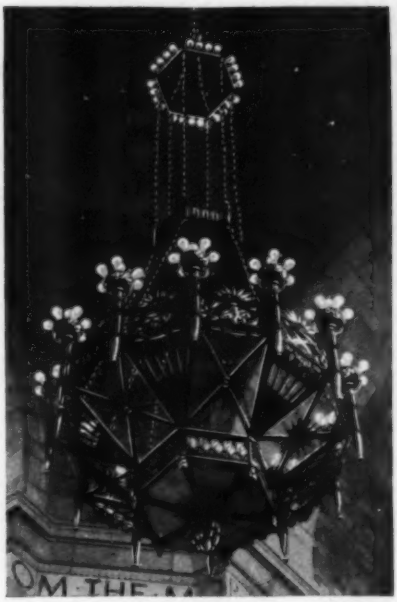
JOINING OCEAN CABLES CALLS FOR SPECIAL HANDS

Of the many odd jobs in modern industry, few demand the skill of the cable jointer's, the master electrician who connects the ends of ocean telegraph cables. His task is all the more difficult because it involves physical requirements that bar many workers. In making a joint at sea, the electrician first exposes the copper core of the cable for several inches back from the two ends and then makes a mechanical "weld." Next begins the difficult part. He softens the gutta-percha on each side of the weld and manipulates it gently with his fingers from both sides of the gap in the insulation toward the completed weld and gradually builds up the section until it is the same size as the rest of the cable and absolutely air and water-tight. Many workers who know the tricks of making the joints are barred, however, for if their hands are inclined to give off an appreciable amount of alkali, they cannot make an air-tight joint. Every jointer is tested in the cable factory before he is permitted to attempt the work at sea. The importance of tight joints is easily appreciated. The last transatlantic cable cost $1,800,000 and has five joints. A break in any one would result in costly delays and great repair expense.

WIRE NET ON GOLF-CLUB HEAD HELPS RECOVER BALLS

To help retrieve golf balls from water hazards, or other difficult places, a chain dip net has been put on the market which is attached to the steel head of the club with a clamp, as shown in the photo. It is quickly adjusted or removed, weighs only a trifle and occupies but little space in the caddy bag.

¶More than half of the coffee grown in Brazil is imported into the United States.



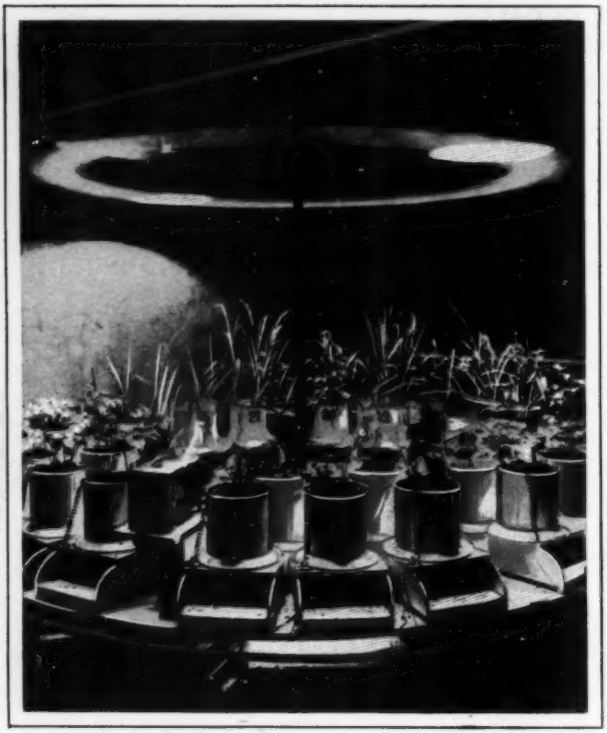
Huge Chandelier Installed under the Dome of the Nebraska State Capitol at Lincoln

CHANDELIER OF MANY LIGHTS WEIGHS OVER TON

One of the largest single pieces of lighting equipment ever made is the bronze and glass chandelier recently suspended from the top of the inner dome of the Nebraska capitol building at Lincoln. It weighs 3,500 pounds, aside from the huge chain that supports it, and holds 136 light bulbs which are specially adjusted to illuminate the huge area.

TINTED GLASS FOR GREENHOUSE HELPS PLANTS GROW

Glass of a greenish-yellow tint as a substitute for the clear variety, is being used successfully for greenhouses and sun boxes in Germany. It is said to give a light much more restful to the workers' eyes and also aids in the germination of seeds. In one test, sixty per cent of the seeds planted sprouted under the colored glass, as against twelve per cent under plain glass. Plants raised under the new glass also remained green longer.



Growing Strawberry Plants under Electric Lights; Development of the Berries Was Rapid, but the Method Is Costly

BERRIES RIPEN IN FORTY DAYS WITH ELECTRIC LAMPS

Strawberries were grown and ripened in forty days, as against the eighty that nature requires, in an experiment conducted by Georges Truffaut and Mr. Thurneyssen, Paris scientists. As a substitute for the sun, they used two 1,200-watt electric lamps set four feet above the plants. While their method was interesting, it holds little commercial possibilities under present conditions, as each berry, so grown, cost about $5.

MYSTERY OF RADIO ECHOES PERPLEXES ENGINEERS

Radio stations in Holland, co-operating with the Norwegian telegraph department, are trying to solve the mystery of short-wave wireless echoes, noticed a few weeks ago when one of the stations broadcast signals on a special wave-length. Repetitions or echoes of the impulses were heard at Oslo at intervals of three to fifteen seconds after the signals left the transmitter. Since the waves travel around the earth in one-seventh of a second, it seemed clear that the delayed signals must have been reflected from space millions of miles beyond the earth and the Heaviside-Keneally layer, which many experts have thought impenetrable to the waves. There is no known body in space at the necessary distance from the earth to reflect the waves at the intervals that were recorded. Professor Stormer, of Oslo, believes that the phenomenon may have been due to the formation of "reflecting surfaces or areas" in space, caused by the position of the sun in reference to the earth at the time the experiments were made. The delayed echoes were not registered at other times of the year. The echo phenomenon was noticed in the months of February, March and October.

BLADE REMOVÈS MORTAR AND PRIES BRICKS APART

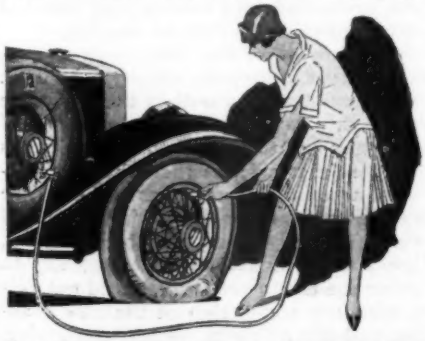
To save time in cleaning used brick, a chipping tool devised by a western man is said to be an improvement over the ordinary hatchet, as it has a more slender blade. It can also be used to pry bricks apart, and is not so liable to break them either when knocking off the mortar or removing them

WORMS GIVEN SPECIAL DIET MAKE BETTER BAIT

Worms kept on a special diet before being used as bait, are more tempting to fish than those that have been just taken out of the ground, the department of agriculture reports. According to W. R. Walton, the worms should be placed in a container partly filled with moistened moss for three or four days before they are used. A special variety, sphagnum moss, found in the damp north woods, is preferable, but other kinds will do. If the worms are kept longer, the diet should be varied with sweet milk every week, and the moss should be washed every ten days. At the end of a few days, the worms become pink in color, which hue is evenly distributed, and, in the water, the contents of the stomach can be seen through the skin. The diet is especially valuable in preparing worms for game fish, such as trout, Mr. Walton found. It makes the worms more lively, tougher and easier to handle and for some unknown reason makes the fish bite much quicker.

TAKE AIR FROM SPARE TIRE TO INFLATE FLAT ONE

Flat tires can be inflated with air from the spare tire through an emergency connection lately introduced for the convenience of the motorist to save using the hand pump. It is applied in a few seconds and may also be used in obtaining equal pressure in all the tires by allowing air



Spare Tire Serves as Air Tank for Emergency Filling of Tire in Use

to pass between them until the pressure is equalized.

Moving-Picture Projector with New Shutter That Overcomes Flicker in Image

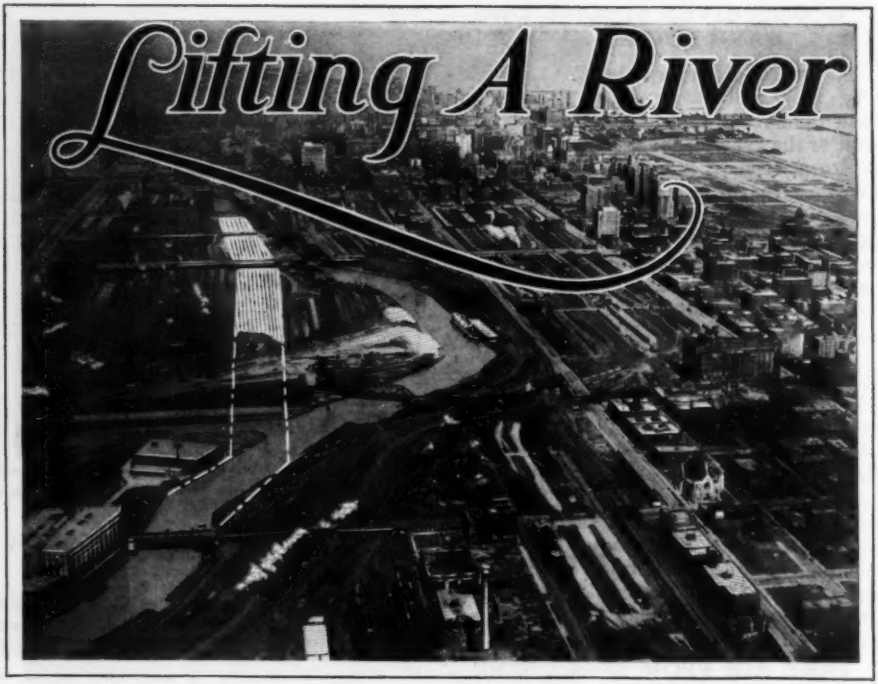
FILM SHUTTER STOPS FLICKER AND SAVES NEGATIVE

Flickerless motion pictures can be made on two-thirds the quantity of negative now required, it is asserted, with the aid of a special projector shutter which a southern inventor has introduced. An important part of the unit is a small auxiliary shutter which runs reverse to the main one and is said to affect the light in such a way that the projecting machine can be run at almost half the rate of the ordinary apparatus and still produce clear, steady pictures. Cameramen will be able to take the films on shorter lengths, thus effecting marked saving on originals and copies, it is suggested.

COIN NEW WORD TO DESCRIBE TELEPHONE'S EFFICIENCY

Progress in science and industry is constantly demanding new terms and one of the latest of these is the word "decibel," coined by telephone engineers to describe the efficiency of telephone circuits. It is a substitute for the phrase "transmission unit." The actual unit decided upon was first called "bel," after the inventor of the telephone. The bel, however, is larger than is needed in practice, and, therefore, a unit one-tenth as large was adopted by engineers and named the decibel.

Lifting A River



Copyright, Chicago Aerial Survey

Chicago Is Taking a Bend Out of Its River to Uncork a Bottleneck South of the Loop District; the White Shows the New Channel Already Dug, and Dotted Lines the Work Remaining

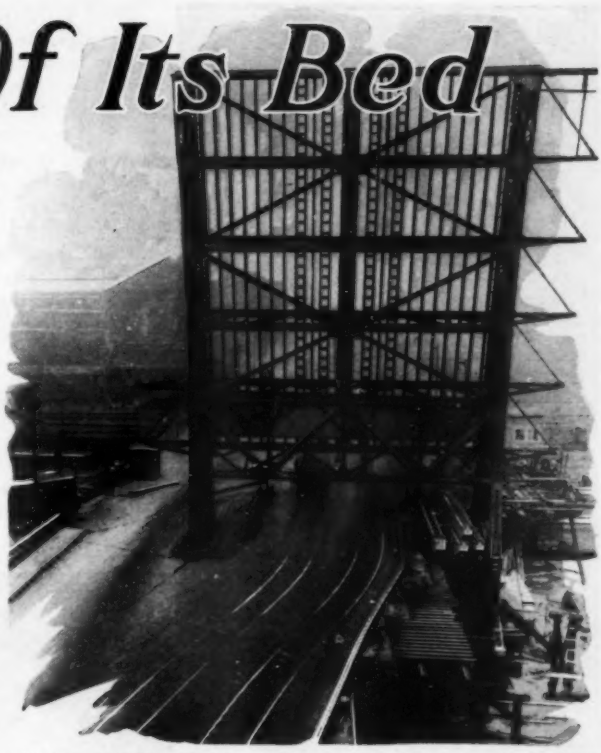
PASSENGERS on incoming trains at Chicago a few months ago were surprised to see the giant steel leaves of a big bascule bridge rising into the air above a busy street, where there was nothing for it to span. While workmen placed the steel, two lines of street cars and all the traffic of a busy thoroughfare poured through the base of the bridge.

Weeks later, with the bridge complete, a portion of the street was removed, the leaves dropped into place, and then a dredge came along and dug a river beneath it. Chicago was off on an ambitious plan to turn a backyard river into a civic asset, flanked with broad double-decked boulevards and lined with mammoth skyscrapers.

As the first step in the new development, the Chicago river—the stream that has run backward since the drainage canal was completed years ago—was unkinked to open a bottleneck that has checked traffic to the south of the so-called "loop" or downtown district of the city, so that three new main traffic arteries could be cut through. To prepare for the digging of the new channel, which removes a big eastward bend of the stream, the city's engineers built the new bridge and had it ready before the channel was dug.

The moving of the river involved a readjustment of property valued at millions. Seven railroads, as well as the city, were affected. Railroad yards on one side of the river had to be sold to rival railroads on the other side, as they changed locations when the stream was moved. The readjustment also took a kink out of all the railroads entering two big terminals, the LaSalle and Grand Central depots. After the tracks are straightened out, following the completion of the new channel and the filling of the old this spring, LaSalle, Sherman and Wells streets will be continued through, to relieve the burden now concentrated on four through streets to the east.

Out Of Its Bed



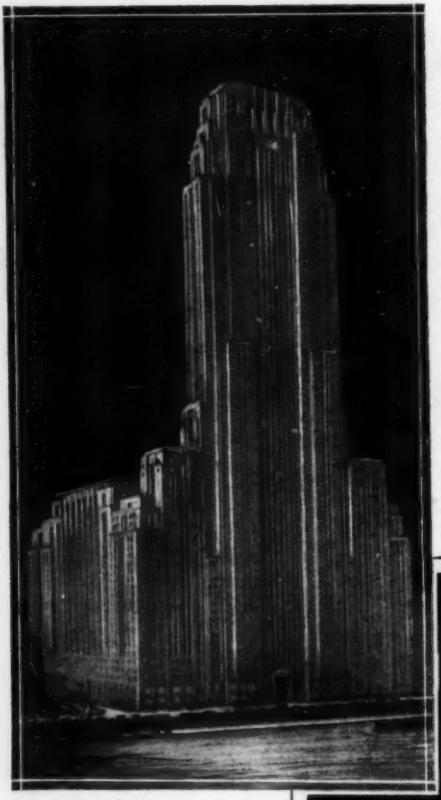
This Bascule-Bridge Leaf and Its Mate Were Built over a Busy Street; Then a River Was Dug beneath Them

The development of the river front as a civic asset really started in 1920, when it was bridged at Michigan avenue with a double-deck structure, the top level for pleasure vehicles and the lower for the freight traffic to the near-by piers and warehouses. Encouraged by that success, the next step was the condemnation and wrecking of the South Water street produce market—several blocks of old three, four and five-story warehouses that backed up to the river—and their replacement by a broad two and three-level street, enabling traffic bound from either the north or west sides of the city to reach the other without passing through the congested loop district. One section of Wacker Drive, the new river boulevard, has three levels, a top one for automobiles, a second one for trucks and drays, and a third street at the dock level.

Architects began to turn to the river front and utilize it in developing new buildings. Two, the new home of the Chicago Daily News and the new Chicago Civic Opera House, each occupying a block of river frontage, face each other across the stream, while the monumental development is carried on westward by the vast concourse and central office building of the new Union station. The opera house, which, in addition to the main theater, seating 3,400, includes a smaller theater for more intimate performances and an enormous office building, is to be opened next fall. The News building will be occupied this spring. The newspaper office structure is built over the railroad tracks adjoining the Union station, the first Chicago building to utilize leased railroad air rights.

Another air-right building is nearing completion, the eighteen-story Merchandise Mart, with three and a half million square feet of floor space, and plans have been completed for a third, to be the tallest building in the world. To be called the Apparel Mart, it will house, in its seventy-five story, 880-foot main structure and tower, an office building, hotel, garage, convention halls, restaurants, two clubs with swimming pools and all facilities of club life, and thousands of feet of display space for wearing-apparel manufacturers.

Fronting two blocks on the river boulevard, with a cross street running through the center of the building, the main entrance will be on the upper street level, with a "mezzanine basement" below and a railroad yard below that, so that Pullman cars carrying parties to conventions



Courtesy Walter Ahlschlager

in the building can deliver their occupants to the elevator doors, to be carried up to the hotel section. Beneath the railroad yards, five subbasements will house the mechanical equipment of the structure, a complete city within itself.

The Apparel Mart is the first unit in a plan for development of sixteen city blocks of railroad-yard air rights, with Grant park on one side, the river boulevard on a second, and Lake Michigan on the third. As the first step in that development, the city has obtained authority from the war department to bridge the river again, this time almost at its mouth, with a new boulevard, linking the Grant park and southern park system with the Lincoln park and north-parks boulevards. Miles of islands are being built in the lake along the city's water front, connected with each other and with the mainland by bridges, so that eventually it will be possible to drive from one end of the city to the other without ever passing through city streets, or being held up by cross traffic.

Describing the plan commission's ideas in river development, Graham, Anderson, Probst & White, architects of the Opera House and Marshall Field company's Merchandise Mart, explain:

"The men whose vision has seen Chicago in its future magnificence, have thought of the grand possibilities of this river, as contrasted with its present un-

Courtesy Graham, Anderson, Probst & White

The Apparel Mart, Top, Will Be the World's Tallest Building, While the Merchandise Mart, Below, Will Have over Seventy Acres of Floors

As Part of a Vast Boulevard-Drive System, Running the Length of the City on Island Parks, Chicago Is Preparing to Build This Bridge across the River Mouth, While a Second Lift Bridge, at the Extreme Right, Will Span a Warehouse Slip; at the Left, a Section of Three-Level Street in the Wacker-Drive Development; the Top for Pleasure Cars, the Second for Trucks, and the Lowest Serving Steamer Docks

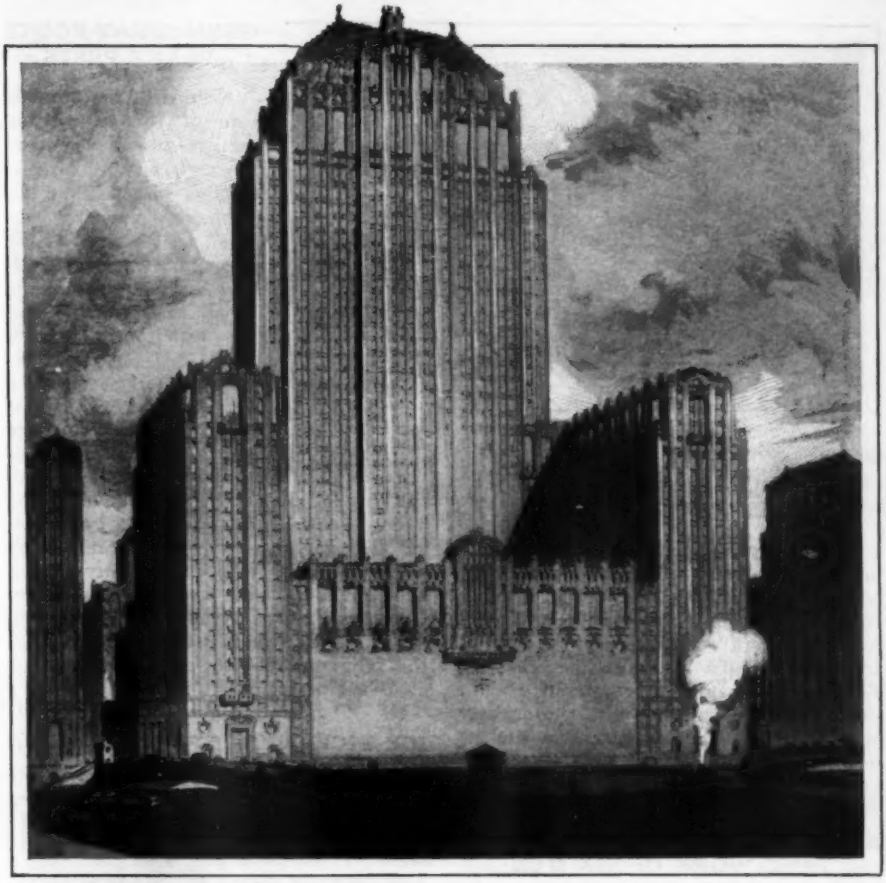
The Double-Deck Michigan Avenue Bridge, with a Lower Level for Trucks; the Truck Level Connects with Wacker Drive

Courtesy Chicago Daily News

Facing Each Other across the Chicago River, the New Daily News Building, Recently Opened, and the Opera House, on the Opposite Page, Are Typical of the New River Skyline

kempt and neglected banks. Great cities of ancient and modern civilization have had similar opportunities. In Rome, the Tiber presented to the builders of the capital of the empire a problem which they handled in their own grandiose manner. The banks of the Tiber, the bridges across it and the islands in the stream were considered as opportunities for embellishment rather than difficulties which could not be handled. The Thames, in London, the embankment and bridges spanning it are as dear to the Londoner's heart as they are admired by the millions of visitors who go to the city. The architects of the bridges and the grand character of the buildings on the banks are reasons why the Thames is thought of as a civic asset to the city. The bridges of Paris and the banks of the Seine have been brought to their present romantic and magnificent aspect by the courage and imagination of the citizens and builders of Paris from centuries ago to the present day. The banks of the Seine and the boulevards at the side are a very fair parallel to our Chicago river possibilities. In Florence, the streets which run alongside of the Arno show what city planners can do by putting the river in front of the city plan instead of back of the buildings along its banks, and the result, while not so pretentious as in Paris, is an extremely delightful one."

In planning the Merchandise Mart, the Marshall Field company voluntarily placed



Courtesy Graham, Anderson, Probst & White

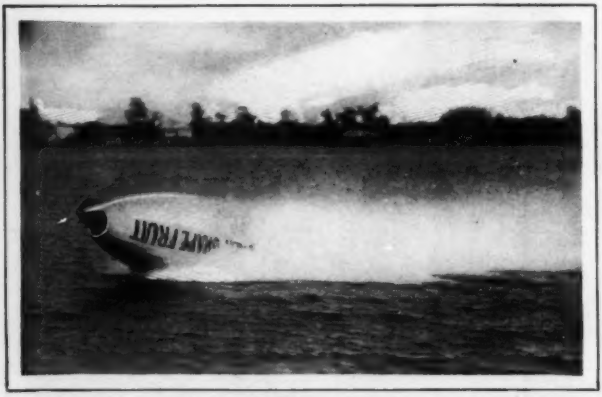
This Vast Office Building and Theater Combined Will Open in the Fall as the Home of the Chicago Civic Opera; the Office Rents Are Expected to Pay the Opera Losses

its river side sixty feet back from the river, sacrificing that much of their land for a double-deck boulevard, which eventually will be a part of a north-bank system rivaling Wacker Drive, on the opposite shore.

Plans for the Chicago of the future were laid many years ago largely through the efforts of the late Daniel Burnham, an architect whose name was closely associated with the development of the skyscraper. As a result of his efforts the Chicago Plan Commission, a private civic organization, has for years prepared plans for boulevard, park, lake-front and river developments under a unified scheme. The various governing bodies accept the plan commission's recommendations, and bond issues supported by the commission usually pass the voters.

One of the projects for which money is to be asked soon is a seven-mile elevated highway, running in a straight line from the turn of Wacker Drive at the bend of the river to the northwest side of the city, to furnish high-speed automobile connections with the northern suburbs, Milwaukee and other Illinois and Wisconsin cities.

¶Write our Bureau of Information, if you wish to know who makes or sells any article described in this magazine. Send no postage; the service is free.



Not an Accident, but a Normal Performance; Outboard Motorboat, after Somersault at Full Speed; Occupant Is Safe Inside

SPEED BOAT IN SOMERSAULTS GIVES WATER THRILLS

Something different in speed craft appeared recently at a Florida resort in an outboard motorboat that rolled over in somersaults at full speed without injury to the pilot. In that respect, the boat is somewhat similar to those used by the Eskimos who can turn completely over in their frail shells and bob out of the water again. The boat is so built that the interior is dry and the occupant is securely kept from falling out.

HOLDER FOR FIRE-HOSE NOZZLE DOES WORK OF SIX MEN

To hold and direct the powerful stream of water from a fire hose at full pressure, usually requires several men, but a unit that is said to do the work of six, thereby freeing them for other duties, has been devised in Scotland. It is simply a tripod arrangement on a substantial wooden base upon which the nozzle can be firmly held and directed at almost any angle by means of levers and a brake, operated by a thumbscrew. Connection is quickly made with a hose.

GERM SPRAY ROUTS PLANT PESTS

Visions of the possible war of the future are seen in attacks scientists are now making against various insects that devour crops and orchards. The pests are being sprayed with a material that is loaded with the spores of a parasitic fungus which kills the insects. A Porto Rico expert recently waged a successful attack against lice that feed on egg plants, peppers and other vegetables. The practical extension of this method depends largely on obtaining a sufficient and cheap supply of the fungus. At present, farmers cannot raise their own because it requires a greater technical equipment than the average farmer commands. Commercial insecticide manufacturers can hardly undertake to raise the fungi because their copper and lime dusts are poisonous to it.

ICE PICK WITH SPRING HANDLE PREVENTS CHIPPING

Operated on a "breech loading" principle, an ice pick now on the market is said to simplify the task of breaking up ice, reduce waste and save time. The point of the pick is placed and kept against the ice while force is applied with the handle that moves up and down as a plunger. A spring inside instantly raises the handle for another tap.

¶Whenever you find that you wish to know more about any article in this magazine, write our Bureau of Information.

Unusual Wreckage: School of Whales, Stranded on South African Shore, Being Removed with Teams for Disposal Before Decay Set In

STORM "SHIPWRECKS" WHALES ON AFRICA COAST

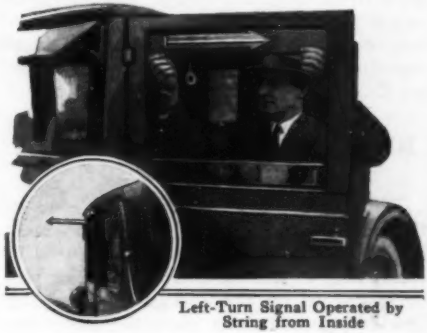
During a severe storm off the coast of South Africa, a large number of whales were washed into shallow water and died before they could swim back from the shoals. Emergency workers were recruited to dispose of the carcasses.

ELECTRICITY IN SMALL TOWNS SHOWS INDUSTRY'S GROWTH

One of the most interesting indications of the rapid development of applied electricity in this country is the spread of transmission lines to hundreds of small towns and villages that now enjoy the same twenty-four-hour service afforded the large cities. Since 1923, more than 4,000 such rural centers have been supplied with electricity for the first time. Light and power are now available to every city and town in the United States with a population of 5,000 or more; ninety-seven per cent of the communities with populations of 1,000 to 5,000 are supplied, and twenty-five per cent of all hamlets with less than 250 population are reached by wires that furnish light and power. Much of this development has been made possible through improved methods of interconnecting lines. During the past fifteen years, the amount of electricity generated in this country has grown 626 per cent.

SIGNAL ARM FOR CLOSED CARS AIDS SAFER DRIVING

Quickly installed and easily operated, an arrow-shaped semaphore to signal a left turn without lowering the window or opening the door of a closed car, has been placed on the market. It is held in place by clips that fit over the glass when it is raised and is extended simply by pulling a cord. When the string is released, the arrow automatically returns.



Left-Turn Signal Operated by String from Inside

One-Thousand-Car Hotel for Automobiles, Built in New York in Effort to Solve Parking Problem

TWENTY-FOUR-STORY GARAGE HOLDS THOUSAND CARS

A hotel for autos exclusively has been built in New York city to help relieve the parking problem. It is twenty-four stories high and has a capacity of 1,000 cars. They are taken to the different floors, parked in selected spaces and returned again to the delivery room, all by electric control, so that no human hand touches them after they are once placed on the elevators.

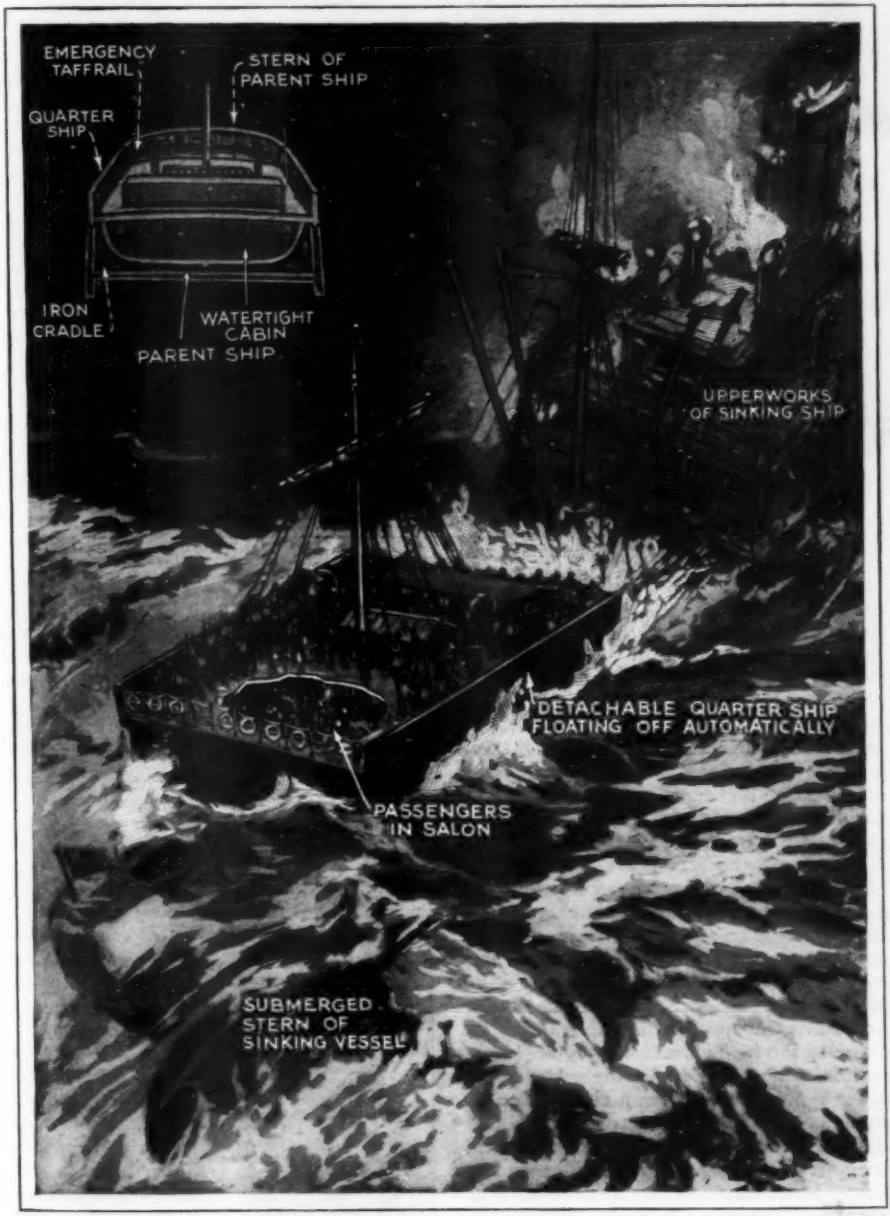
NEW ENGLAND PICTURE ROCK MYSTERY SOLVED

Dighton rock, which has been one of the pet mysteries from prehistoric America, has been explained by Dr. Edmund B. Delabarre, of Brown University. The pictures carved on the surface of this gray bowlder, gained fame when the Rev. Cotton Mather included the rock in his book on the wonderful works of God. Since then, the rock has done multiple duty bolstering up theories that the eastern coast of America was visited by the Phoenicians, the lost tribes of Israel, the Chinese, the Druids, and the inhabitants of the traditional lost continent of Atlantis. Doctor Delabarre explains that, in photographing the rock by flashlight, he revealed, beneath the childish pictures and signs, traces of the name Miguel Cortereal and the date 1511. Miguel Cortereal was one of two Portuguese brothers who sailed to Labrador in 1501. Later, the other brother sailed back home, and Miguel, who expected to follow, was never heard of again. If Doctor Delabarre's interpretation of the badly worn Roman lettering is correct, Miguel reached New England and lived there for at least ten years. It also means that the scrawly picture writing on the rock was cut in later and probably is Indian in origin. One difficulty encountered by those who would study Dighton rock is that it stands at the edge of a river, and is exposed by the tides for only brief periods.

TABLE ON TOP OF RADIATOR HELPS PROTECT WALL

A radiator top that may be used for a table in winter or summer, helps keep discolorations from the wall and also directs the heat sidewise rather than upward into the room. It is easy to adjust and remove for cleaning.

THE LATEST INVENTION FOR SAVING LIVES AT SEA



Copyright, D. MacPherson

Duncan Campbell, an English Designer, Has Proposed a Detachable Quarterdeck, Complete with Cabins, Food Supplies and Wireless, to Save Lives at Sea; Ordinarily It Would Rest within the Ship's Hull, but Would Float Free If the Vessel Sank

NIGHT IS TURNED INTO DAY FOR TRAPSHOOTERS

Trapshooting by Night, with a Battery of Floodlights to Illuminate the Clay Pigeons; the Shooters Themselves Stand in Darkness behind the Bank of Lights

This is an age of light and it is not surprising that the trapshooting world should feel its influence. Floodlights totaling 2,000,000 candlepower have proved sufficient for lighting up trapshooting fields for night tourneys. F. W. Ralston, lighting engineer of the General Electric company, who was the first to conceive the idea of floodlighting baseball diamonds for night playing and has been instrumental in lighting soccer fields and golf links, is the man who has made practical the shooting of clay pigeons after sundown. Lights had to be so placed that the beams did not shine into the eyes of the gunners and yet furnished sufficient illumination to sight over the barrels and follow the birds in their flight thirty feet into the air and sixty feet away from the trap house. Because the pigeons were, as a rule, black, yellow rings painted on their backs enabled the gunners to get a clear vision of them as they passed through the beam of light. Lighting the gunners' platform without detracting from the light on the field was accomplished by suspending four deep steel reflectors above the heads of the shooters and two projectors behind them. These were placed fifteen feet apart on top of posts eighteen to twenty feet high. Mr. Ralston stated that the earliest form of trapshooting at night was done by Buffalo Bill and Anne Oakley with glass balls lighted by means of arc lights suspended in the air. Anne Oakley also did some shooting at targets on the ground. This was about 1894.

ORNAMENTS FOR SHADE CORDS ADD BEAUTY TO HOME

Ornaments of non-shatterable glass, decorated with colored designs and figures that will not fade or disappear in washing, have been introduced for shade cords and light "pulls." They are easily attached, help form a grip on the cords, present an attractive appearance, both in artificial and natural light, and are furnished in many different designs.

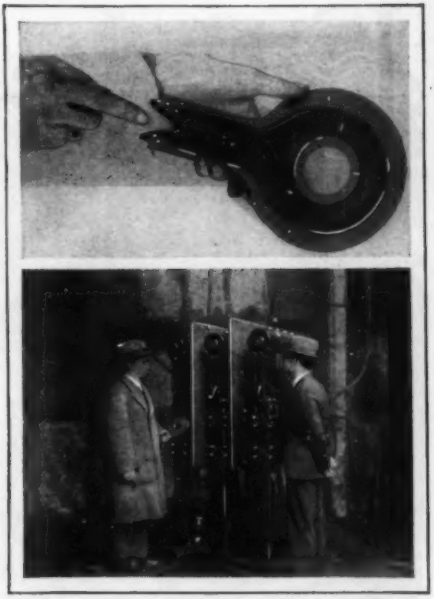
AIR-COOLER CABINET FOR HOME TO ROUT SUMMER HEAT

Automatic refrigeration has been developed in a room-cooling cabinet for greater comfort in summer. It is compactly built and contains a cooling coil over which the air is drawn and then directed back into the room at a temperature that soon cools the entire room. In tests, the cabinet lowered the temperature of the average-size room as much as ten degrees in thirty minutes. The outfit is so constructed that the fan it contains may be used alone, without the cooling apparatus, and the moist coils also serve to wash out impurities in the air.

ROLLER MAPS FOR AUTOISTS LATEST AID ON TOURS

At the turn of a knob, information is furnished the traveling motorist from maps, neatly and securely held in a small roller cabinet. The outfit does away with clumsy folders, torn pages and other inconveniences, is about the size of the average book, and holds three rolls that unreel like camera film. Rolls not in use are stored in the container. The special maps prepared for this holder are said to contain important information for tourists, which is not generally included in the ordinary guide maps.

Roller Map for Autoist, with Roll Arrangement That Keeps It in Compact and Handy Form



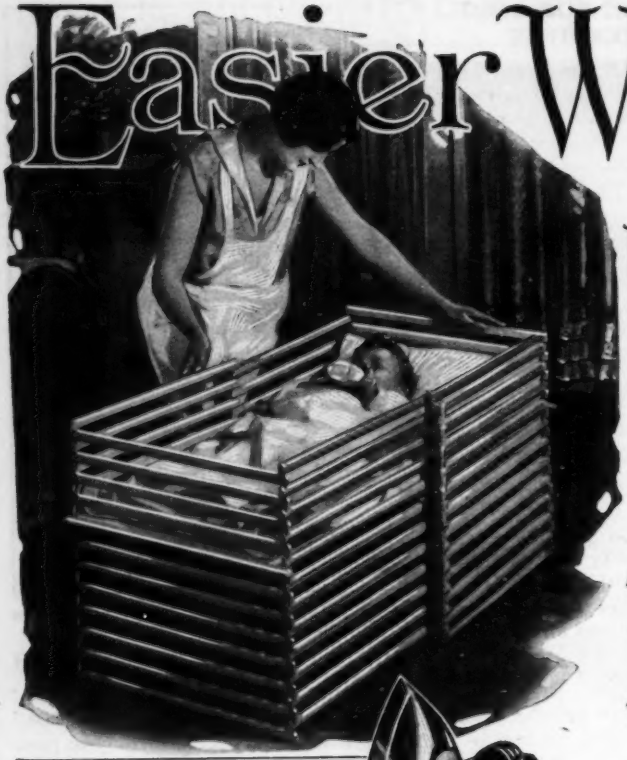
Circuit Breaker Which Stops Flash and Saves the Electric Fuses by Absorbing the Heat

CIRCUIT BREAKER STOPS FLASH AND SAVES FUSE PLUGS

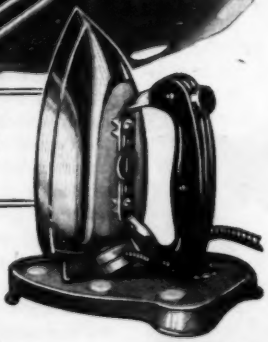
Instead of having to replace plugs when they blow out, it is necessary only to push a small rod, somewhat like an ordinary light switch, when the house circuit is interrupted. This is possible with a device made available through the development of a new type of circuit breaker for high-power commercial circuits. It consists chiefly of two copper plates that perform two "important tricks with the current," eliminating the flash that usually occurs when a circuit is broken. The plates split the current into many smaller circuits and, second, they affect it in such a way that the heat ordinarily produced is reduced to such a degree that it will not even scorch a cotton thread held in the path of the current. The secret of the process is that the copper plates are made to accomplish the practical reverse of what usually happens, that is, instead of creating heat, the current is absorbed.

¶Our Bureau of Information will answer all questions regarding articles appearing in this magazine.

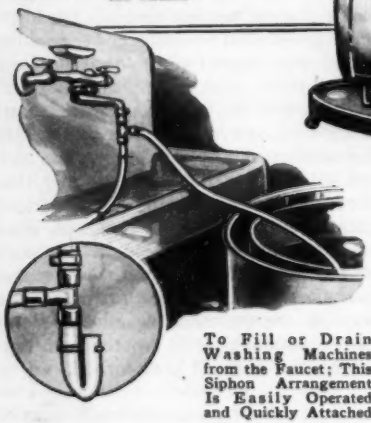
Easier Ways



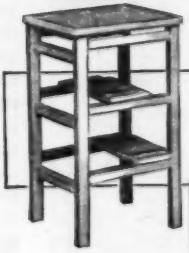
Collapsible Crib for Baby Is Easily Set Up or Taken Down and Fits into Small Space When It Is Folded Up; the Bed Itself May Be Adjusted to Different Heights



This Electric Iron Has a Ventilated Handle of Bakelite in Different Colors and a Control Switch Operated by the Thumb



To Fill or Drain Washing Machines from the Faucet; This Siphon Arrangement Is Easily Operated and Quickly Attached



Stool and Ladder Are Combined in This Useful Article for Kitchen and Other Service; the Top Locks Open for Support

# of Doing It

Electric Stove for Use on Table Has Burner Plate and Oven; It Will Cook, Bake or Roast and Keeps Foods Hot; Operated from 110-Volt Direct or Alternating-Current Socket

Electric Floor Buffer Gives a High Polish with Little Labor After Wax Is Applied; It Reaches Difficult Places and Weighs But Fourteen Pounds

Detachable Chair Pad, Below, Is Furnished in Different Colors and Designs and Is Washable in Certain Materials; a Heavy Felt Foundation Promotes Comfort; Loops at Rear Hold Pad in Place

At Left, Attractive Holders for Serving Dishes Add Beauty to the Table and Protect Cloth; They Are Made in Sixteen Sizes

"BEEHIVE" AIRPORT AND HOTEL TO HOLD MANY PLANES

Model of "Beehive" Airport to Accommodate Forty Planes; Central Structure Is a Hotel

More than forty planes will be able to land and take off simultaneously from a proposed "beehive" airport, a model of which was displayed recently. The field is circular and is dominated at the center by a dome-shaped hotel, 850 feet high. At the top of the structure is a mooring mast for dirigibles. Tunnels provide passages, to and from the hotel and landing stations, to automobiles and transportation lines outside the field.

RADIO HELPS TO REPAIR SHIP DAMAGED AT SEA

How radio helped in repairing an ocean liner, crippled by a damaged rudder, 700 miles from New York, is one of the latest triumphs of wireless. The cargo carrier "Silver Maple" had encountered a severe storm. Her rudder and rudder stock were damaged. United States revenue cutters set out from Boston, 500 miles away, to lend assistance and plans were made for repairing the rudder. But no detailed drawings of the ship were available at the New York offices. A radiogram was dispatched to England by the steamship officials, asking that sketches be prepared from the original plans and sent back at once. The drawings were ready in a few hours and were then shot through space by radio photography. The following day, less than forty-eight hours after the first message had been sent to London, the plans were on their way to a shipbuilding plant at Chester, Pa., and work was at once begun on the new rudder stock. Meanwhile, the steamer proceeded under her own power to Bermuda. The new rudder stock was sent there and installed. Officials estimate that radio was instrumental in saving at least $7,000 and more than a week's time.

PAPER CLOTHING IS WASHABLE AND KEEPS ITS SHAPE

German manufacturers are reported to have introduced paper clothing that can be washed, does not crease and is quickly restored to its proper shape by shaking. It is waterproof, affords ample circulation of air and is considerably lighter than cloth. A winter overcoat that would weigh about six pounds if ordinary material were used, would weigh only about half a pound in the paper.

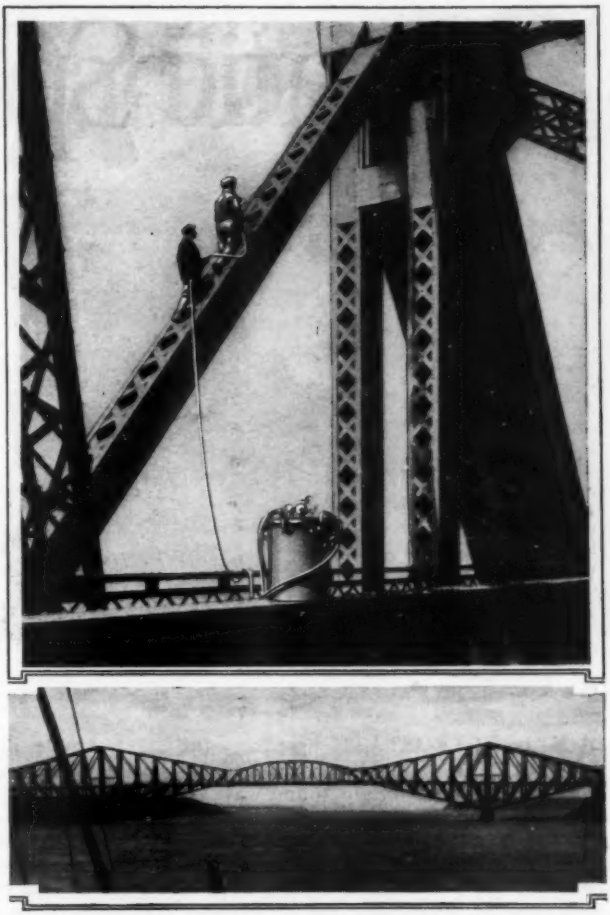
GAS-FILLED AUTO STOPLIGHT MORE EASILY SEEN

Installed on the inner side of the rear window of the car, where it can be seen more easily, a stoplight now on the market uses the glowing color of an illuminated gas instead of the usual filament bulb. The tubing is filled with a mixture of gases that produce the familiar penetrating hue now commonly seen in electric signs. Current is supplied from a specially designed spark coil, inclosed in a splash-proof casing and placed anywhere in the car. The light is easily removed for cleaning the rear window.

Stoplight of Neon-Tube Type Installed on Rear Window of Motor Car

PAINTERS RISK LIFE ON BRIDGE JOB

Perched at a perilous height, a workman pumps a fine spray of bright green paint upon the upper steel work of the huge cantilever bridge that spans the St. Lawrence river at Quebec. To fall would mean a drop of 300 feet. Naturally, the worker must stick to his job! The man is one of a small army of painters who are performing one of the largest jobs in the world. Before they have completed the task of applying a single coat, they will have pumped 30,000 quarts of paint upon the bridge, which is 2,830 feet long. Its center span is 1,800 feet in length. The work requires the united efforts of thirty-five men, working continuously from June 15 to September 15 each summer, over a three-year period. While they are engaged, a gang of mechanics is carefully inspecting every movable part and applying grease and oil. Apart from the 7,500 gallons used to give the bridge one coat, it requires seventy gallons to cover each one of the main posts, or 280 gallons for the four. The task involves several problems. The bridge is exposed to temperatures ranging from ninety degrees above to thirty-one degrees below zero. The surrounding atmosphere is frequently moist and foggy, and dew often coats the entire structure until eleven o'clock in the morning, meaning that the work must be arranged accordingly. Strong winds sometimes carry the paint away from the nozzles of the spray guns even when they are held within a few inches of the steel. The gang includes a blacksmith and a boatman. The smith makes scaffold hooks and other units needed while the boatman is posted to rescue anyone who falls into the river.



Painters at Work with Sprayer on the St. Lawrence River Bridge at Quebec; Below, View of the Whole Span

PIGEONS CARRIED IN AIRPLANE TO RESCUE FLYERS

Carrier pigeons are taken on some of the airplanes operating in Alaska. Should the planes be forced down, the birds would be released and would fly back to a base with a message for aid. The plan was adopted after several near-tragedies in which pilots were compelled to make forced landings in remote districts.

Static Speaker-

Colin Kyle, with His Electrostatic Speaker, Less Than an Inch Thick, Built into a Fire Screen

AN ELECTROSTATIC speaker—the most direct method ever evolved for converting electricity into sound waves—is to go on the market in a few weeks.

It has no coils or magnets and no moving parts. Essentially it is nothing but a condenser, two flat plates separated by a thin sheet of insulation. In the form in which it is being produced, it consists of an aluminum stamping about nine by twelve inches, with edges turned back three-quarters of an inch. The face of the plate is punched to form approximately 700 small slits, an eighth of an inch by about five-eighths. Over the face, a sheet of insulation, only one five-hundredth of an inch in thickness, is placed, and a thin coat of metal sprayed over the surface, or, in lieu of the spray method, a sheet of foil glued down.

A single plate can be used as a speaker, or any number of them may be bolted together through holes drilled in the turned back flanges. One speaker, built to go behind the screen in Roxy's Theater, New York, is eight feet square. The average household size probably will have four or six units. In operation, one side of the radio receiver output goes to the metallic plate and the other to the metal or foil coating which forms the diaphragm. In addition, a positive bias of 450 volts of direct current is applied to the aluminum plate. The result is that the portion of the diaphragm in front of the slits in the plate vibrates—690 separate vibrating units in a single plate, or 4,140 in a six-plate speaker, all of them working in unison.

A single plate produces considerable volume, a speaker with six plates bolted together has a volume equal to the best of the dynamic types. The reproduction of voice and music is clear and exceptionally true. There is none of the overemphasis of the bass which mars the output of most dynamic types, no alternating-current hum, no noticeable muffling or mushiness in the voice, and the range, from the lowest note to the highest, is well covered. The only noticeable extraneous sound is a low murmur like that of a distant blower fan when the speaker is operated with considerable volume. As the output is tuned down, this sound of moving air decreases and fades out.

Because of its shape, it can be built up in cabinets no more than an inch thick. It can be hung or mounted flat against the wall, built into ornamental screens, or into a table-type cabinet, as a part either of the front panel or of the lid. In addition to several types for separate use, eight manufacturers have been licensed

New Radio Marvel

The Speaker Itself; in His Hands, Kyle Has the Thin Aluminum Plate; the Other One Is Completed with Foil Covering

to use the electrostatic reproducer in manufactured sets.

The principle of an electrostatic speaker is not new, but until recently no one had discovered a practical way of making one. Two appeared in Germany some time ago, one made by Hans Vogt and the other by Eugene Reisz. They did not attain any great popularity abroad, and only a few were imported in this country. Essentially both inventors used the same method, stretching a diaphragm between two metallic plates, the latter being separated from the diaphragm by a dielectric. In the Vogt speaker, a bias of as high as 850 volts is used on one of the plates, and to protect users from this high potential, this plate is hidden within the speaker cabinet. Both speakers had the drawback of being difficult to make and expensive, and both had a tendency to develop faults in operation, notably that dust particles would get in and cause a short circuit between membrane and plate until the discharge of the current burned the dust away, and incidentally punctured a hole in the membrane.

A thirty-four-year-old school-teacher, who had taught in desert schools in California and Arizona, solved the principal problem. He is Colin Kyle, and the new speaker, which is shortly to make its appearance in this country, is his invention. His chief work consisted in the development of a dielectric which provided sufficient insulation in sheets only one five-hundredth of an inch thick, and a construction plan that is simple, practical and cheap.

In tests at the Wallace Sabine laboratory of acoustics, at Riverbank, Ill., Prof. Paul Sabine found the Kyle speaker to be more nearly perfect than anything that has been produced up to this time.

Why and how the Kyle speaker works may be explained, in non-technical terms, as follows: The portions of the membrane over the slits in the plate are free to move slightly, and may be drawn into mechanical vibration in response to alternating-current oscillations within the limits of auditory vibration. It is necessary, however, to subject the plate to a constant voltage that is higher than the greatest voltage to which the membrane will be subjected by the radio-receiver output. The reason for the necessity of this positive potential, from a direct-current source, on the plate is interesting. Without it, the membrane would respond twice to each

A Radio and Speaker Console Combination; Vogt and One of His Speakers, and the Back of a Kyle Model, Showing the D.C. Potential Unit

fluctuation of the alternating-current output of the receiver, instead of once, and the result would be a note just one octave higher than it should be.

One of the defects of the original German speakers was that the membrane was stretched under considerable tension, and a mechanically strained membrane can never vibrate in its true "sine-wave" manner. Instead, its movement is uneven and produces tones two, three or more octaves higher than the fundamental. In the Kyle receiver, the method of applying the membrane does away with all stretching.

The static speaker rounds out the field of radio sound producers. First there were magnetic speakers, both air-column and cone types, following closely the idea of the telephone receiver. Then came the dynamic types, and now the static. How far the new speaker may go toward replacing the others is problematical, for, as Professor Sabine recently pointed out, the test of a good speaker is not so much its technical perfection as its effect on the listener's ear, and not all ears are alike. A speaker will be loudly praised by some listeners and as loudly condemned by others, merely as it happens to please or displease the listener's ear.

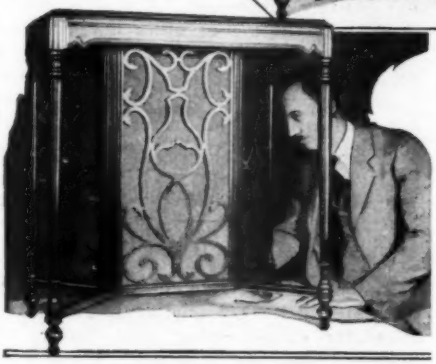
One drawback which air-column speakers have faced is that any device which was theoretically perfect, from the standpoint of the propagation of sound waves, would not be a loud speaker, as it would have no power to amplify the sounds put into the horn by the diaphragm of the speaker unit. Amplification of sound in a horn is the result of resonance, which in turn is the result of theoretical imperfections in the shape of the air-column chamber.

The exponential horn was the nearest development to a theoretically perfect air column. A sound wave, started down a tube, literally explodes when it reaches the end. The theory of the exponential horn is that the shape of the chamber is so

perfectly graduated that the expanding sound wave literally "doesn't know when it reaches the end," as Doctor Sabine puts it.

If that were actually true, and the horn itself were not resonant, the sound emitted at the end of the horn would be no louder than that produced by the speaker unit alone.

The exponential horn, and air-column speakers in general, had another serious drawback—the great length of air column needed to get a full range of tones, including the bass. It is possible to build such a horn that will reproduce as low notes as a good dynamic cone, for example, but it would have to be at least sixteen feet long. An eight-foot exponential air column has a natural period of vibration at sixty-four cycles, while a sixteen-foot column has a natural period at thirty-two, and with a still longer air column or horn the low note, which occurs at the first natural period of vibration, would be correspondingly lower. Another fact that should be noted in this connection is that lengthening of the horn brings closer together the recurring natural periods, which, in a sixteen-foot horn, would be multiples of thirty-two, instead of the multiples of sixty-four, as in an eight-foot speaker.



The Condenser Speaker Made Up into a Screen, and, Center and Bottom, the Back and the Front of a Console Model

Besides the fact that the imperfections of the horn produce the amplification of sound, it is to be noted that the imperfections in the natural periods of the diaphragm of the speaker unit produce modifications in the original source of the sound. Therefore, a unit which may be good on one maker's speaker, because its imperfections and the imperfections of the air-column chamber co-operate in such a way as to more or less neutralize each other, may be a decided failure on another shape and size of horn.

While the length of the horn fixes the lowest note which an air-column speaker can reproduce, the size of the baffleboard is the controlling factor in cones of both the magnetic and dynamic types. A baffleboard four feet square is roughly equal

Jess Hawley, Famous Football Star, Now a Speaker Manufacturer, with a Radio Set and Speaker Combination, and, Right, a Separate Kyle Speaker

to an eight-foot horn, in other words, it will reproduce sixty-four-cycle notes. It takes a baffle eight feet square to equal a sixteen-foot horn and get down to thirty-two cycles.

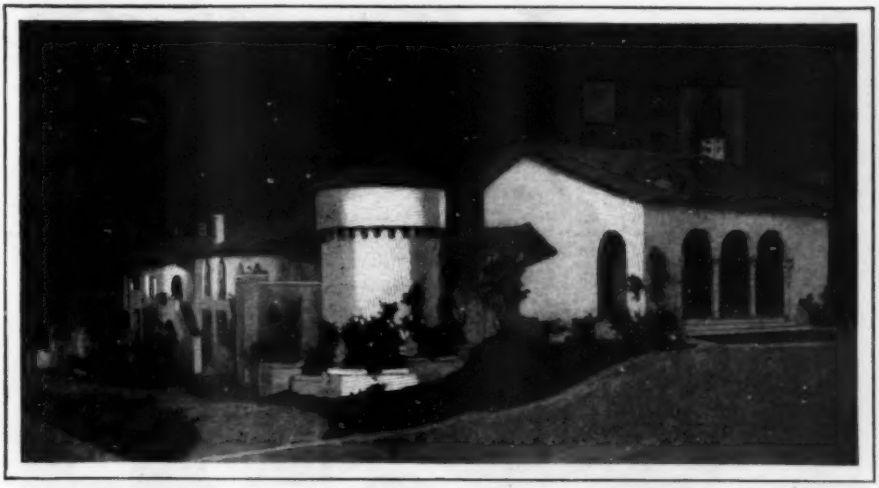
Two problems of interest to radio users, one of which is of special interest also to the public in general, have been studied in the Sabine laboratory. One is the question of proper acoustics to get good reproduction, and the other the problem of soundproofing walls to prevent transmission of sounds to adjoining rooms or apartments.

As it happens, the ordinary living room, with its curtains, drapes, rugs and furniture, is just about as satisfactory a setting for music reproduction as can be found, according to Professor Sabine. The reason is that people are accustomed to the acoustic properties of the ordinary home, and therefore music reproduced in such a room sounds right. In his laboratory Professor Sabine has a sound-absorbing room, with walls, ceiling and floor covered with a thick blanket of soft absorbent felt and wool to kill the resonance of the walls. Trying to talk in such a room has a peculiar effect. The elimination of the usual echoes gives a sensation of heavy air pressure on the ears, as though one were incased in a high-pressure air lock, such as are used in tunnel digging. A room of this type was built in a New York bank for the adding-machine department, and after six months' trial the girl machine operators unanimously agreed they did not like it.

The other problem, sound deadening, which has become an important one in apartment houses since radio, talking machines and similar musical instruments have become so common, depends, according to Doctor Sabine, entirely on the weight of the material in the walls. Sound-absorbing materials, which are soft and porous, are ineffective. Instead, the walls must be built of material so heavy that their ability to vibrate, and therefore transmit sounds to the other side, is minimized if not entirely eliminated. A wall of heavy bricks, plaster, tile or other material can be made an even more effective sound deadener by dividing it into two sections with an air space between them. The inner wall will transmit a certain part of sound vibration to the air space, but this reduced sound will have a correspondingly lessened ability to vibrate the outer wall.

COLORED ICE CUBES

By placing vegetable coloring matter in the water in the compartments of the refrigerator cube-freezing pans, blocks of different hues are obtained. These add an interesting color note and permit unusual effects in table decorations.



Realistic Model of Home Used by Architects in Explaining Details to Clients; the Roof and Floor Are Removable So That the Interior of the Replica May Be Studied

MODELS OF HOME AID BUILDER AND PROSPECTIVE BUYER

California architects are building scale models of residences to aid their clients in forming a more accurate idea of their future homes. The roofs and floors of the replicas are removable so that the interiors, with plumbing and other features revealed, may be carefully examined.

BEE HAS POOR EYESIGHT TESTS WITH LIGHT BAND SHOW

A bee's eyes are only about one per cent as efficient as those of a human being, recent tests have shown. Scientists allowed bees to walk up a sloping glass plate beneath which was a moving slide with alternating dark and bright bands, giving a sort of picket-fence effect. The bee would change the direction of its march when it saw the bright bands moving, and it paid no attention to bands that were too narrow for it to see. By using a number of slides with varying widths of bands, it was possible to find the narrowest object which a bee can perceive. This was found to be 100 times as wide as the narrowest object which a human being can observe at the same angular distance. Bee and human eyes were found to be alike in that both see poorly in a dim light and better in a bright one. At certain degrees of brightness, however, no improvement in sharpness of vision could be discovered.

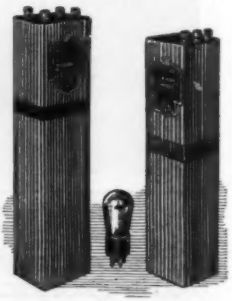
COIN SORTER AND COUNTER SAVES BANK TIME

Coins are counted and sorted in one operation with a simple device lately demonstrated in England. The pieces fall from a hopper upon moving screens which separate the coins according to size. The outfit is intended especially for banks.

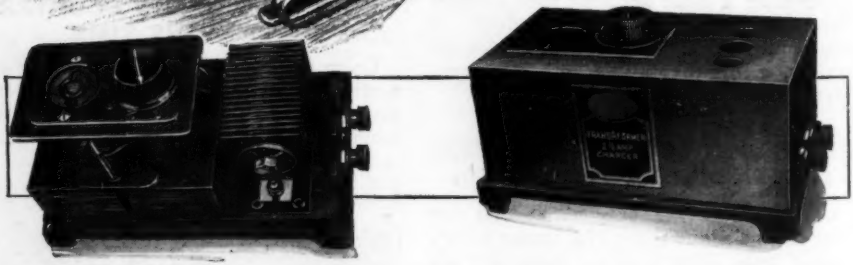
Coin Counter and Sorter Which Replaces Hand Labor in Banks and Large Commercial Houses

Latest *from the*

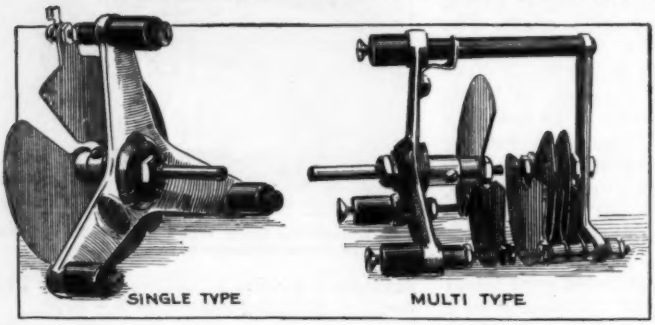
Compact Filter Unit, Designed for Use with Small Motors, Eliminates Troublesome Interference from Household Appliances; It Is Plugged into the Line as Shown in the Sketch



Above, New High-Voltage B-Batteries Designed for Use in Television and Radio-Equipped Airplanes

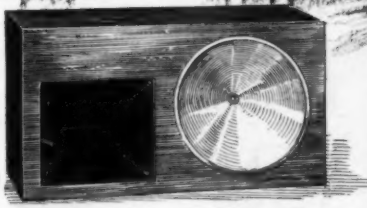


Above, a Complete Rectifying Unit Assembled in One Case Includes a Tapped Step-Down Transformer and Rectifying Device with a 3-Amp. Capacity; It Is Designed for Use with a Standard A-Filter for Assembling an Efficient A-Battery Eliminator; an Outlet Is Also Provided for the B-Eliminator



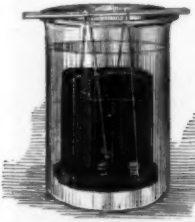
Left, Two New Condensers Especially Designed for Short-Wave Circuits; the Single Type Is a Two-Plate Variable, So Arranged That the Stator Plate May Be Moved for Maximum Capacity; the Multi-Type Is a Combination Semi-Fixed Tank and Variable Vernier Condenser and Is Designed for Low-Power Transmitters, Complying with the New Government Regulations in the Narrow Bands Allotted to Amateur Operators

Radio Shops

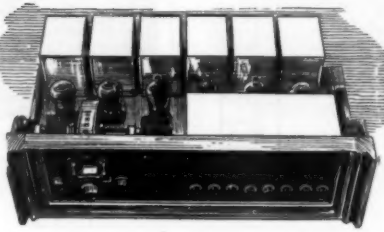


Above, Cone and Exponential Horn, Combined in One Unit, for Installation in Consoles; the Unit Is Designed So That Either or Both May Be Employed

Left, an Efficient Indoor Antenna and an Attractive Lamp for the Radio Cabinet Are Combined in This Unit, Built to Represent a Broadcasting Microphone; the Necessary Fixed Condensers, Switch and Lamp Socket Are Inclosed within the Neat Metal Shell



Left, a Demonstration to Prove the Moisture-Proof Qualities of a New A.F. Transformer; It Was Suspended in a Beaker of Water for One Week, after Which It Worked as Well as Ever; Section Diagram Shows Core and Coil Sealed in Bakelite Case



Right, Six-Tube A.C. Screen-Grid Receiver Has Automatic Control; Automatic Tuning Is Made Possible by a Mechanical Device Arranged So That the Dial Condensers Are Automatically Removed Whenever a Selection Is Made on the Automatic Finder

Above, the Owl Conceals an Automatic Cut-Off Switch Which May Be Set to Operate at Any Time the Set Owner Desires

Using Lamps as Resistance Units

THE USE of ordinary incandescent lamps as resistances in experimental radio work is common practice with a large number of fans with limited pocketbooks. Anyone can take advantage of these cheap resistance units, and many broadcast listeners and set builders are beginning to find out for themselves that the incandescent lamp is really nothing but a resistance which passes a predetermined amount of current. Its only disadvantage is the bright light, but bulbs may be painted or shaded so that this will not be objectionable.

The lamps are mounted in ordinary porcelain sockets and arranged in any convenient manner for the nature of the work to be done. Fig. 1 shows how a series of lamps are employed as a voltage divider for a homemade B-eliminator of the type having a total output of 180 volts. The usual voltage divider for an eliminator of this type has a total resistance of about 10,000 ohms obtained by a combination of variable and fixed wire-wound resistors. A 10-watt lamp has a resistance of about 1,000 ohms so ten of them in series, as shown, will provide an equivalent resistance. If the filter output is 180 volts, there will be a drop of 18 volts across each of the lamps in series. Begin at the negative end and count up two tubes and you have approximately 36 volts for the detector plate, or three tubes up gives a voltage of about 54 volts, this procedure being followed to obtain the other voltages desired. Of course, the space occupied by the lamps is much greater than with resistors of modern type but the saving of several dollars makes it worth while where space is not a consideration.

Another interesting use for an incandescent lamp is shown in Fig. 2, where it is placed in series with the primary of the power transformer for the purpose of reducing the output of the B-eliminator when the latter is in excess of the voltage required to operate the set properly. Lamps of various wattage should be tried,

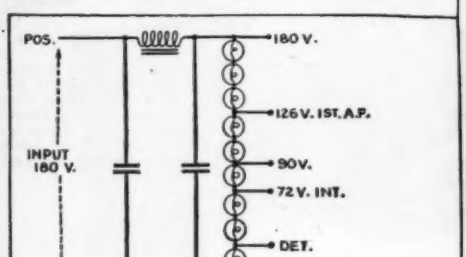


FIG. 1

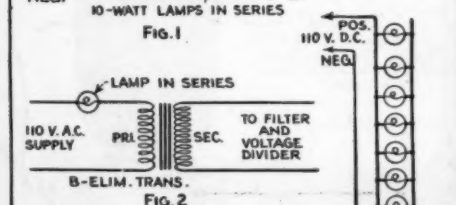


FIG. 2

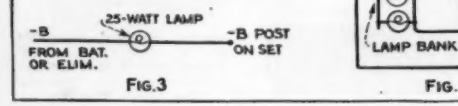


FIG. 3

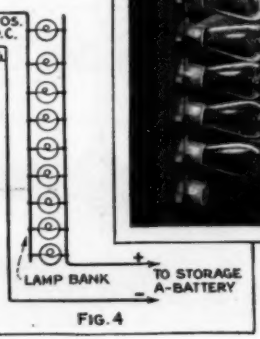


FIG. 4

Bank of Lamps and Various Ways of Using It in Connection with Radio Receiver or for Charging Batteries

and the total output in each case should be measured with a B-eliminator voltmeter until the lamp of the correct size for the job is found.

As a safety device, a lamp may be connected in series with the plate supply to protect the tubes, as shown in Fig. 3, and one of the 25-watt type will protect the tubes as well as the standard fuses employed for this purpose. It need not always be renewed, as in the case of a fuse, for it will not burn out unless the short is caused by a voltage higher than 90. An additional advantage the lamp has over the fuse is that it will light up as a warning signal. The resistance in the circuit is too slight to interfere with the operation of the set, and the idea can be applied to any type of receiver.

The most common use of lamps in d.c. districts is shown in Fig. 4 for charging storage batteries directly from the lighting line. The bank is arranged as shown in the photo and diagram. The battery is connected across the lighting line with as many lamps as are necessary to obtain the proper charging rate, the bank of lamps being connected in series with one side of the line to cut down the current. A 100-watt lamp, or its equivalent in smaller lamps, will permit about 1 amp. of current to pass to the battery. In this way the charging rate may be made any value the builder desires. The arrangement is sometimes used as a trickle charger and left on continuously. To obtain the necessary ¼-amp. rate for this purpose, a 25-watt lamp should be used, and for a ½-amp. rate, a 50-watt type. This idea is, of course, limited to d.c. districts, and the builder must determine the polarity of the d.c. line before connecting the output terminals to the storage battery. This is a simple matter, and may be done by placing the terminals in a glass of water in which a pinch of salt has been dissolved, keeping the terminals about 1 in. apart. Bubbles will appear at both terminals, but the discharge will be greater at the negative wire.

It is a good plan to mark the wall supply plug in addition to marking the wire, if the plug is of the plug-in type, so that it will not be reversed if the lamp bank is disconnected from the house supply at any time.

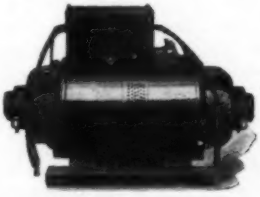
Battery of Horn and Trumpets for Large Volume; Above, Close-Up of Horn, Giving Idea of Size

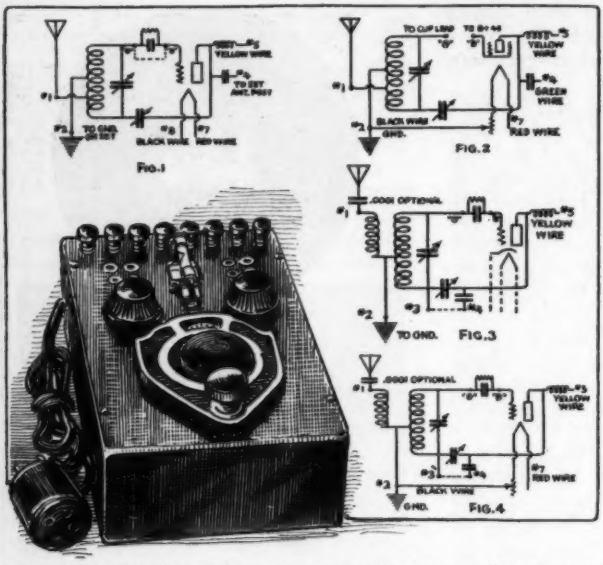
Battery of Horns for Sound Effects

The battery of exponential horns shown is for use in motion-picture theaters and other public places where great volume is necessary. The large bell-type horn measures 9 in. at the small end, 32 in. at the large end and is 52 in. long. The two trumpets above it measure ⅞ in. at the small ends, 24 in. at the large ends and are 60 in. long.

Operating A.C. Apparatus on D.C. Supply

The motor generator shown in the illustration is specially designed for operating 60-cycle a.c. radio receivers, loud speakers and phonographs singly or in combination from d.c. lighting sockets without objectionable noises of any kind. The instrument is equipped with filters and is said to give better results than are obtained from the ordinary 60-cycle lighting supply.





Lower Left, Unit of Many Uses, Showing the Arrangement of the Controls and the Adapter Plug for Connecting It to the Receiver

New Radio Unit of Many Uses

The new radio unit shown in the illustration not only tunes out troublesome stations but will serve as a short-wave receiver, short-wave adapter, regular broadcast receiver, screen-grid preamplifier, remote-control adapter, extra stage of tuned r.f. amplification, r.f. booster, single-dial converter, audio oscillator, wave trap and wave meter. Yet it is small and the binding posts are conveniently arranged at one end for easy connections to any part of the radio receiver. The plug-in coils supplied with the unit cover a short-wave range of from 20 to 80 meters. The adapter plug provides a quick connection to the sockets in the receiver, and the unit is designed to work separately or in connection with either an a.c. or d.c. set. The binding posts are numbered and the wires from the plug are of different colors to avoid confusion and to simplify the various hookups.

Practically any of the standard types of tube may be employed, one of the principal features being the use of a screen-grid tube as an r.f. amplifier, which provides great volume. Fig. 1 shows the unit employed as an r.f. booster in connection with an a.c. receiver employing type-226 tubes. Fig. 2 shows its use as a screen-grid preamplifier in connection with a d.c. receiver employing type-222 tubes. It is employed as a 20 to 80-meter short-wave converter in Fig. 3, with an a.c. receiver operated with type-227 tubes. Fig. 4 shows the hookup as a short-wave adapter to convert a d.c. receiver using 199, 201-A or 112-A tubes for short waves. The increased sensitivity of the receiver is claimed to permit the use of a short indoor or light-socket antenna. This unit, together with a scanning disk, motor and neon tube in connection with the audio amplifier, makes of practically any standard set a suitable television receiver for the various programs now on the air.

FOR THE RADIO BUILDER

The simplified blueprints listed below include the best of Popular Mechanics tested circuits. When ordering, simply quote the numbers of the blueprints desired and inclose the proper amount in an envelope addressed to Popular Mechanics Magazine, Radio Dept., 200 E. Ontario St., Chicago, Ill. Back magazines containing full descriptions of the circuits can also be obtained. Inclose an additional 25 cents for each magazine desired, giving date of publication.

No. 111, Homemade Tube Tester July 1926 . . 25c
No. 115, 15 to 550-Meter Three-Tube Receiver . . . . . Nov. 1926 . . 25c
No. 116, Three-Tube Loop Set Dec. 1926 . . 25c
No. 117, Simple Electrolytic B-Eliminator . . . . . Feb. 1927 . . 25c
No. 123, Economy-Nine Superheterodyne . . . . . Nov. 1927 . . 50c
No. 126, Homemade B-Battery and Charger . . . . . Jan. 1928 . . 25c
No. 130, One-Tube Short-Wave Adapter . . . . . Mar. 1928 . . 25c
No. 131, Five-Tube All-Electric Receiver . . . . . Apr. 1928 . . 25c
No. 134, Edison Type B-Battery . July 1928 . . 25c
No. 135, Screen-Grid Browning-Drake Receiver . . . Sept. 1928 . . 25c
No. 138, Screen-Grid Perfect-Tone Six Receiver . . . . . Nov. 1928 . . 25c
No. 139, Simple Television Receiver . . . . . Dec. 1928 . . 25c
No. 140, Power Amplifier and B-Supply for Television Jan. 1929 . . 25c
No. 141, Hammarlund-Roberts Hi-Q 29 Junior A.C. Receiver . . . . . Feb. 1929 . . 25c
No. 142, Two-Tube Screen-Grid Short-Wave Adapter . Mar. 1929 . . 25c

FOUR-TUBE SET OPERATES DYNAMIC SPEAKER

By F. L. BRITTIN

HERE'S a four-tube set that gives six-tube results; without a doubt the most powerful little receiver we have ever met, capable of operating any dynamic speaker on locals, including even a giant theater type, without the aid of additional equipment.

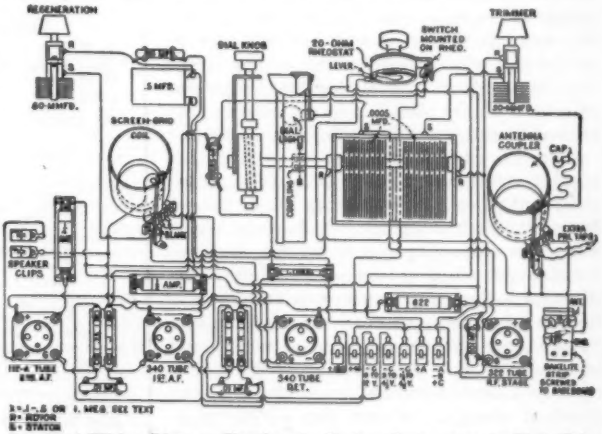
It combines volume, tone and selectivity with simplicity and low cost, making it an ideal set for the average builder. The short test log, obtained through strong local interference, shows that this receiver has the necessary sensitivity to step out for DX-reception, the distant stations coming in with good volume on a standard dynamic speaker.

This unusual efficiency is, of course, easily accounted for, as the circuit employs the well-known r.f.-amplifying characteristics of the screen-grid tube, and has a 340 hi-mu detector tube with regeneration in addition to the usual two stages of resistance-coupled a.f. amplification.

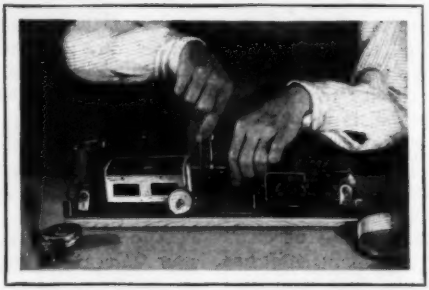
If volume sufficient for the average magnetic cone or exponential horn is desired, for locals only, this can be obtained with but one stage of a.f., and it is, of course, a simple matter to omit the last stage, if the builder prefers a three-tube set.

The assembly is very simple. The parts needed are few, but these have been carefully selected and are especially adapted to the circuit. The antenna-coupler coil is of the two-winding type, with extra primary taps which may be shorted to ground for the purpose of obtaining a suitable input for individual antenna and location conditions. The two outside lugs include the entire primary winding. The large coil is the secondary, one terminal of which is located on the strip at the top of the coil and the other on the center lug below. The screen-grid r.f coil is a special type, consisting of a high-impedance primary and exceptionally low-loss secondary. The large winding of this coil, instead of being the secondary, as in the usual case, is the primary, and is tuned with a .0005-mfd. condenser.

The 50-mmfd. midget condenser across the .0005-mfd. antenna-tuning condenser is employed as a trimmer; the other 50-mmfd. midget condenser (the stator plates of which are connected directly to the plate of the detector tube and one terminal



Simplified Wiring Diagram Showing the Various Instruments in Their Relative Positions



Top, Sawing Off Unused Length of Shaft at Rear of Ganged Condenser Unit; Above, Mounting Flexible Coupling for Shaft Extension

of the small winding) is used as a "snubber" for controlling regeneration. In a way, it also acts as a trimmer, making possible a very delicate balance without loss of volume or selectivity. These coils are connected in the circuit in a manner which enables one to aid the other; in order to do this, run the B-positive lead up through the large coil and connect it at the top, while the other end of the large coil is run from the center lug below to one side of the .00025-mfd. condenser, as shown in the simplified wiring diagram.

The baseboard may be of poplar, or similar wood, and is ½ by 7 by 17 in., and the front panel, 3/16 by 7 by 18 in., of bakelite or similar material. A drilling template for mounting the drum dial and its escutcheon plate comes packed with the dial and is designed to accommodate baseboards of various thicknesses. The midget condensers are mounted at each end of the panel, and the rheostat, with its accessory filament-switch assembly, in the position shown. Mount the escutcheon plate on the panel, then screw on the tuning unit with the two flat-head screws provided. Now place the front panel in position against the baseboard and fasten it temporarily to the metal brackets. The two .0005-mfd. condensers, which are ganged together in what is known as "battleship" fashion, are permanently alined, with a free-moving rotor. This condenser unit is now mounted on the baseboard with the short end of plates at the front, and must be carefully lined up so that the shaft is in line with the hole in the tuning-unit drum. Place the unit so that the other end is 2⅛ in. from the right end of the baseboard, viewing the assembly from the rear. With a pencil, carefully trace a line on the baseboard around the mounting posts located under the unit. Complete circles are not necessary, as the center points, for drilling the holes for mounting screws, may be located in half circles. The holes are now drilled in the baseboard to pass three 10-32 machine screws; these screws are 1 in. long and, if a baseboard thicker than ½ in. is used, it will be necessary to countersink the holes from the bottom. Three brass bushings are supplied with the drum dial;

ABSTRACT OF TEST LOG

January 8, 1929; time 9:30 p. m.; testing time three hours. Equipment used: B-eliminator, A-eliminator, dynamic speaker (four-standard types), light-socket antenna.

All local stations, good volume, tone and selectivity

WJSK, Gary, Ind.	40 Miles
WGHP, Fraser, Mich.	236 "
WAPI, Auburn, Ala.	575 "
KMOX, St. Louis, Mo.	259 "
WTMJ, Milwaukee, Wis.	90 "

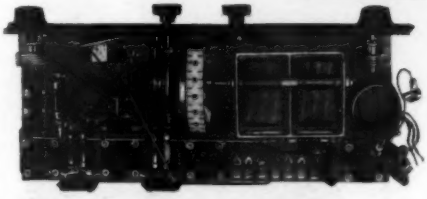
Jan. 9; two-hour evening test, same equipment

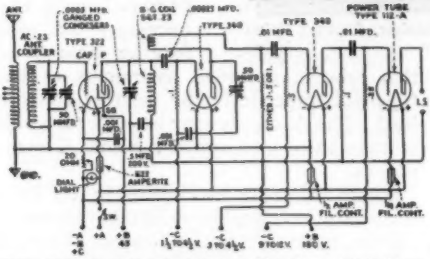
KDKA, Pittsburgh, Pa.	411 Miles
KMA, Shenandoah, Iowa	380 "
WPG, Atlantic City, N. J.	715 "
WOWO, Ft. Wayne, Ind.	170 "
KMOX, St. Louis, Mo.	259 "

Comment: Very little overlapping of locals and none which could not be completely separated by adjusting the trimmer-condenser. Set very quiet, no squeals unless regeneration is forced; volume on locals at resonance terrific but easily controlled. All distant stations received with good volume on dynamic speakers.

these are necessary to raise the condenser unit to the desired height. The bushings are drilled to pass No. 6 machine screws, so they must be drilled again to pass the No. 10 screws. This may be done by placing the bushings in a vise and employing a hand drill. An alternative would be to cut bushings of exactly the same height from brass tubing or build them up from small brass washers. Saw off the unused length of the shaft at the other end of the unit, as shown in the top photo on page 830, and be sure that you do not saw off the wrong end. The bushings are now placed under the condensers, the screws passed up through the baseboard, and tightly screwed into the condenser unit mounting posts.

A piece of ¼-in. round brass rod, 2⅛ in. long, is now mounted on the end of the shaft by means of a flexible coupling, which is held in position by





Top, Completed Set in Cabinet Placed on Table-Type Dynamic Speaker; Center, Looking Down on Completely Wired Receiver; Bottom, Wiring Diagram

four small setscrews, as shown in the center photo on the same page. This extension is necessary to provide room on the shaft for the dial and extends through the tuning-unit drum, where it is held tightly with two machine screws. The completed assembly is clearly shown on this page.

Remove the front panel and complete the baseboard assembly, arranging the parts exactly as laid out in the simplified wiring diagram. Complete as much of the baseboard wiring as possible, with the front panel removed, using "celatsite" wire and flexible rubber-covered hookup wire where flexible leads are required. Make all leads as short as possible, wiring in "beeline" manner. This may not look as good as square turns and grouped wiring, but is far better than parallel and long roundabout leads. Mount soldering lugs on the condenser frame, by means of short 6-32 machine screws, in the holes provided under the shaft at each end of the condenser gang, these lugs providing the rotor connections as the rotors are grounded to the frame. When as much as possible of the wiring on the baseboard is completed, mount the front panel on the brackets. The builder will find it advisable to use a wood screw at the lower center of the panel, to make a rigid assembly. Insert the condenser-shaft extension through the dial and tuning-dial drum; now, with the knob mounted on the shaft extending through the front panel, rotate this drum as far as it will go to the left, and, with the condenser plates "all in" or fully meshed, tighten the two screws through the holes in the drum. Rotate the knob at the front until the condenser plates are entirely out of mesh, adjust the dial on the condenser shaft until the zero mark is lined up properly in the front window of the escutcheon plate, and lock the dial in position with the setscrew provided. To obtain room behind the panel and use

the drum dial, the battleship-type ganged condensers are reversed, and this necessitates the use of a reverse-scale dial, that is, one reading from 100 to 0 instead of from 0 to 100. The manufacturer makes both types. Those who wish to gang their own condensers instead of using the battleship type may do so and, in this case, the 0 to 100 scale should be used.

Clips for the battery and speaker terminals were used in order to keep the cost at a minimum, but the builder can arrange a binding-post strip if desired. The antenna and ground clips are mounted on a small bakelite strip, which is screwed to the end of the baseboard for convenience. The extra primary leads on the antenna-coupling coil are just long enough to short any lead to the ground clip as desired. For those who wish to go to the expense of a tapped primary switch, the bakelite strip may be enlarged to accommodate it.

Rear View of Completed Receiver, Showing Tubes in Position

Go over the wiring carefully to be sure that it corresponds to the wiring diagram in every detail as far as point-to-point connections are concerned.

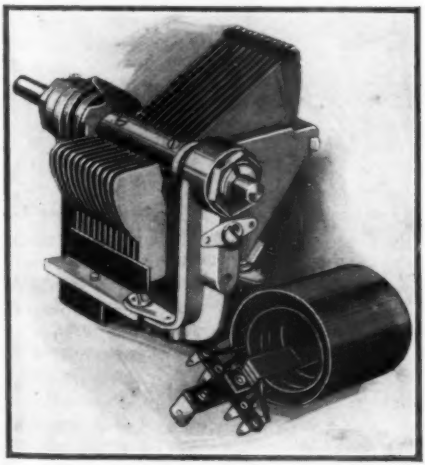
The B-supply may consist of four 45-volt B-blocks, or any standard B-eliminator which will provide the necessary 180 volts for the plates and 45 volts for the screen-grid terminal. The C-batteries consist of three 4½-volt tapped units in series; note that the detector tube is a 340 hi-mu type, and that the grid return is to C-negative, varying from 1½ to 4½ volts according to the tube and condition of the B-supply. This bias value also depends on condenser balance, which is obtained by use of the trimmer condenser. Unless the set is balanced carefully and the proper negative bias used on this detector-tube, regeneration cannot be obtained. That is, the midget condenser used to control regeneration will have no value; so move this negative C-tap from 1½ to 4½ volts on the C-battery until the condenser functions. It may be necessary to try all three resistor values indicated at X for the detector-plate resistor, as one of the three will usually be found to work best. The C-bias for the 340-tube in the first a.f. stage may vary slightly from the values given, as in the laboratory model 1½ volts provided sufficient bias. The C-negative bias for the 112-A power tube in the last stage should not be less than 12 volts for correct operation. The 20-ohm rheostat in the negative filament lead of the screen-grid tube acts as a volume control, and the necessary 3.3 volts for the filament of this tube is provided by means of the type-622 amperite in the positive filament lead. The A-supply may be either a 6-volt storage battery or one of the new A-eliminators.

There are great possibilities in this little set for the builder, but to obtain maximum results, he must learn to tune and balance it so as to maintain regeneration. The antenna may consist of a light-socket plug, short inside antenna, or a short and long outside installation, as desired. In crowded localities, where sharp tuning is essential, the short indoor type will give the best results. If there are any points that do not seem clear to the reader or if additional information is desired, address your letters to Popular Mechanics radio department, 200 E. Ontario St., Chicago.

Blueprint No. 143, describing in greater detail the construction of this unusual four-tube receiver, is now available. It may be obtained for 25 cents together with a complete list of the parts used. The list of parts will be mailed free to readers who do not desire the blueprint.

New Parts for Screen-Grid Circuits

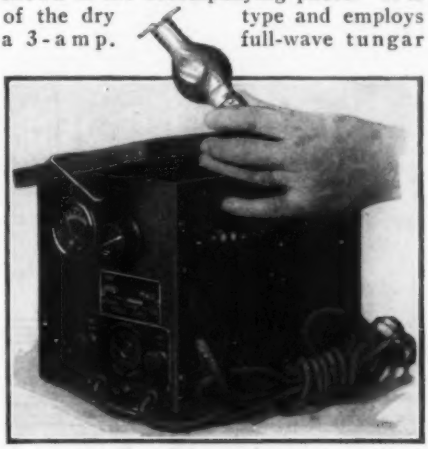
The new screen-grid tube, known as the UX-222 or CX-322, requires coils of special design if full advantage of its exceptional properties is to be secured. A screen-grid r.f. transformer of this type is shown in the illustration, the coils being of the low-resistance, space-wound, self-supporting type, 2 in. in diameter. The high-impedance primary of this r.f. transformer has three taps, so that the required selectivity may be balanced against maximum usable amplification. The tap leads are conveniently located on the bakelite terminal strip. A special antenna-coupler coil is also available which has three taps for varying degrees of selectivity and pick-up with any type of receiver. These taps also permit its use as an efficient interstage transformer in standard-tube circuits of the straight and neutralized mid-tap primary types. The variable condenser suits any modern layout. The plates are shaped to avoid crowding of stations on either the upper or lower bands and to retain normal separation in the middle of the scale. Adjustable ball and cone bearings, floating rotor shaft and excellent low-loss design, make this an ideal tuning unit for modern circuits. The rotor shaft may be entirely removed and a larger one inserted for coupling other condensers in tandem.



Above, Variable Condenser with Removable Shaft for Tandem Coupling; Below, Specially Designed R.F. Coil

A-Unit Employs Three-Ampere Bulb

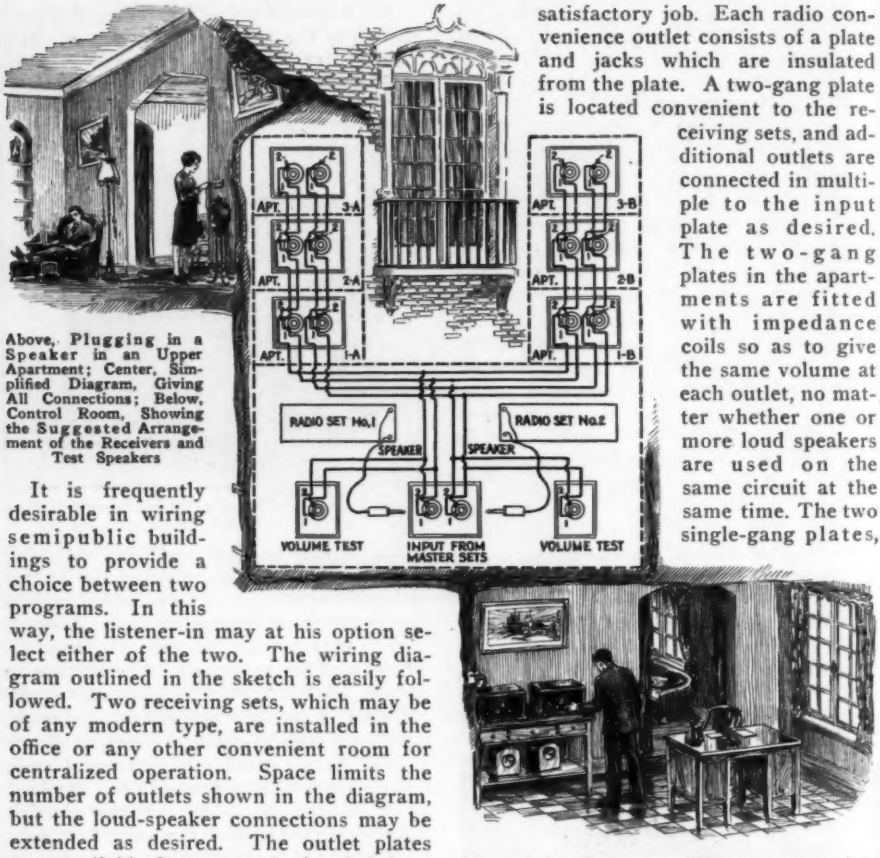
An A-power unit of excellent design is shown in the accompanying photo. It is of the dry type and employs a 3-amp. full-wave tungar bulb. It may be employed with sets using from 5 to 10 tubes, including the 112 or 171 power tubes, and is provided with a meter for exact voltage control. A single switch may be used to control A and B-power and set operation. The voltage as shown on the meter is adjusted by the rheostat; a special electrostatic condenser, combined with oversized chokes, produces a filter circuit capable of filtering 4 amp. This is considerably greater than the load of a 10-tube set. The tungar rectifier bulb is claimed to give the smoothest possible filament supply with a minimum of hum. A-power units of this type are gaining in popularity, as they not only eliminate the messy and troublesome storage battery but make possible all-electric operation of sets employing d.c. tubes.



Dry A-Power Unit Showing Three-Ampere Full-Wave Tungar Bulb

¶When a set using a B-eliminator suddenly goes dead though the eliminator seems to be still delivering the full output voltage, the trouble is usually found to be a break-down in the variable resistor which controls the detector-plate voltage; this may be quickly remedied by replacing the defective resistor with a variable resistance, such as a clarostat of the universal-range variety, and adjusting it until the signals are satisfactory.

Radio-Wiring Suggestion for Apartment Building



Above, Plugging in a Speaker in an Upper Apartment; Center, Simplified Diagram, Giving All Connections; Below, Control Room, Showing the Suggested Arrangement of the Receivers and Test Speakers

It is frequently desirable in wiring semipublic buildings to provide a choice between two programs. In this way, the listener-in may at his option select either of the two. The wiring diagram outlined in the sketch is easily followed. Two receiving sets, which may be of any modern type, are installed in the office or any other convenient room for centralized operation. Space limits the number of outlets shown in the diagram, but the loud-speaker connections may be extended as desired. The outlet plates now available fit any standard switch box. In some cases, the switch boxes may not be required, but they will make a more satisfactory job. Each radio convenience outlet consists of a plate and jacks which are insulated from the plate. A two-gang plate is located convenient to the receiving sets, and additional outlets are connected in multiple to the input plate as desired. The two-gang plates in the apartments are fitted with impedance coils so as to give the same volume at each outlet, no matter whether one or more loud speakers are used on the same circuit at the same time. The two single-gang plates, located in the control room convenient to each set, enable the operator to test for volume and proper tuning.

Variable Resistance Replaces Filter Choke

The use of an output transformer, or a choke and condenser combination, is common practice in coupling the output of the power tube with the input of the loud speaker. Several radio experimenters have lately substituted a suitable variable resistance for the choke coil in combination with the condenser, eliminating distortion frequently caused by core saturation in the choke coil. The resistance must be accurately set for the conditions as well as for the loud-speaker volume desired, and takes the place of the usual choke coil. If a 171-A or 112-A power tube is used in the output, a standard clarostat will serve as the adjustable resistance, while, for the 210 or 250 power tube, whether alone or in push-pull amplification, the power type of clarostat is suitable. With this resistance, core saturation is avoided as well as burn-outs and open circuits, and, in addition, an excellent volume control for the loud speaker is provided.

Two New Tubes

A screen-grid tube adapted to a.c. use is now available. It has five prongs for the Y-type socket and the usual cap at the top for the control-grid lead. The maximum plate voltage is 180 volts with 75 volts at the screen-grid terminal; the plate current drain is 4 milliamp. and the heater requires 2.5 volts at 1.75 amp. The usual control-grid negative bias is 1.5 volts, and to reduce the hum in some circuits, it will be necessary to employ 9-volt bias in the heater lead. It is claimed the tube will deliver a signal twenty to forty times greater than that obtained with the standard 201-A tube. Special circuits and careful shielding are necessary to obtain maximum results with the tube, and filters and special shielding in all leads entering the stage shields are important. The tube may be used as a detector, either with gridleak or grid bias, with from 25 to 45 volts on the screen-grid terminal. Another new tube is a medium-power output type, an improvement over the 171-A. It is said to have an undistorted power unit of 1.6 watts, as compared with .7 watt for the 171-A and 1.7 watts for the 210 tube. The filament is of the rugged raw a.c. type, and draws 1.5 amp. at 2.5 volts.

Speaker Is Built of Concrete

This novel loud speaker stands in the yard of a home in Williamsburg, Ind., and is built of reinforced concrete. It is 8 ft. 8 in. high and weighs 600 pounds; the bell is 34 in. in diameter, and the air column tapers down to ¾ in. at the base. When the owner plugs his radio amplifier into this horn, the entire village can listen in on the program.

Power Amplifier, Showing Dynamic Speaker in Position for Compact Installation

Compact Power Amplifier for Dynamic Speaker

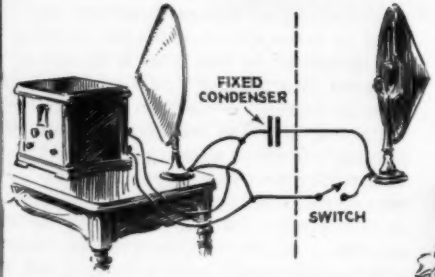
A new power amplifier which also serves as a base for the dynamic speaker makes a very compact unit for installation in radio consoles. The power amplifier may be used as a separate instrument where it is not practical to use it as a base. It is plugged into the last audio socket of any type of battery or electric radio set, thus supplying a stage of amplification employing one of the new super-power tubes. The power unit is plugged into the light socket and the dynamic speaker obtains its a.c. power from a receptacle on the amplifier. A 280 rectifier tube and either a 210 or 250 power tube are employed.

Output Filter Is Important

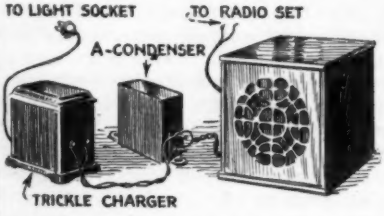
The use of an output filter is important in order to prevent damage to the speaker when the high voltage necessary for power tubes is employed. There is another reason for its employment, however, that is of equal importance. Due to the resistance of the speaker windings, when power tubes are employed, there may be a drop in voltage across the speaker amounting to as much as 30 volts. This means that another 45-volt B-block must be employed in order to make up for the loss, in a battery-operated set. When the output filter is employed this additional block is unnecessary, and such losses are avoided.

Tips from the

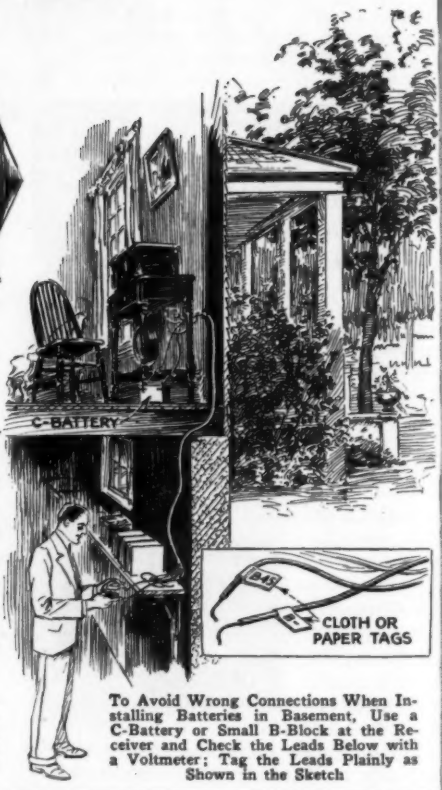
Matching Homemade Coils with Condensers for One-Dial Operation; When Wired for Test, Slowly Pull Bared End through Lug, and When Coils Match, Solder Wire to Lug



Simple Method of Connecting an Additional Loud Speaker to a Set without Impairing the Efficiency of the Regular Speaker; the Capacity of the Fixed Condenser Used May Be .5 Mfd.

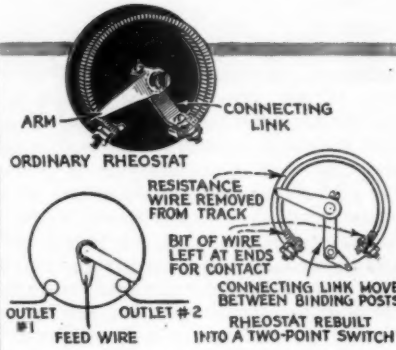


Energizing a Dynamic Speaker of the 6-Volt Battery-Operated Type from the 110-Volt A.C. 60-Cycle Line by Means of a 3-Amp. Trickle Charger and a Standard A-Type Condenser Unit

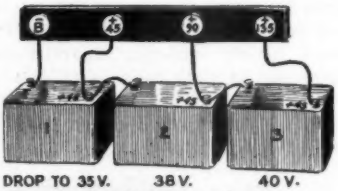


To Avoid Wrong Connections When Installing Batteries in Basement, Use a C-Battery or Small B-Block at the Receiver and Check the Leads Below with a Voltmeter; Tag the Leads Plainly as Shown in the Sketch

Radio Lab.

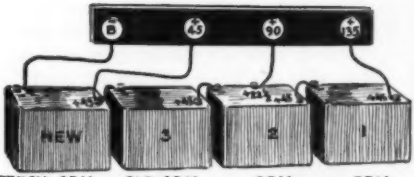


Double-Throw Switch Made from Old Rheostat; Remove Arm and Remount Connecting Link on Machine Screw between the Posts, Mount in Usual Manner and Connect as Shown



DROP TO 35 V. 38 V. 40 V.

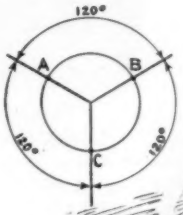
OLD BATTERIES ON SET



FRESH 45 V. OLD 40 V. 38 V. 35 V.

ADDING A FRESH BATTERY FOR BEST SERVICE

Additional Service from Old B-Batteries May Be Obtained if They Are Rearranged According to Their Value as Shown at the Right; the Fresh Battery Is Used for the Detector

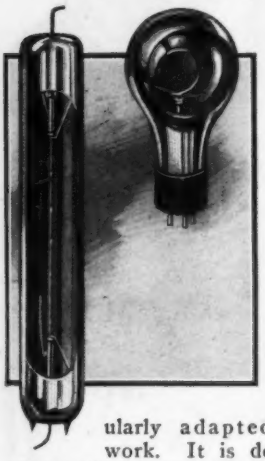


Locating the Position of Holes around the Circumference of a Tube for Mounting Brackets or Contact Lugs; Points A, B and C Are Obtained with a Protractor

A Nail Provides a Means of Forming a Neat Terminal Loop; the End of the Wire Is Then Wound over the Insulation to Cover Frayed Ends

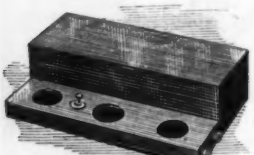
Photo-Electric Cells of New Design

For television and other applications new photo-electric or light-sensitive cells have lately made their appearance on the market. These cells are made in the hard vacuum and gas-filled types, as well as in bulb and tubular shapes. The spherical cell at the right is designed to fit a standard X-type socket and is particularly adapted to television work. It is designed for use where the so-called direct illumination system is employed, that is, when the object is floodlighted and the photo-electric cell is scanned with a rotating perforated disk. It is also used for picking up varying light through film as used in the broadcasting of radio movies and may be employed as an input to an amplifier for sound-recording films. The tubular type is for television broadcasting by scanning the object with a spot of light.



Double-Impedance Amplifier Unit

The compact amplifier unit shown is available for set owners and builders who wish to improve the volume and tone quality of their receivers. It employs three tubes, one of which is a standard power tube; the circuit is the tuned, double-impedance type and is said to give undistorted reception at greatly increased volume. The amplifier is ready to install and with it is included a built-in output filter, inserts for loud-speaker cord and plainly marked battery cable. Its length is 10 in., width 6½ in. and the height is 2½ in. The double-impedance unit is hermetically sealed in a compound which protects the windings from electrolysis, a frequent source of trouble in transformers.

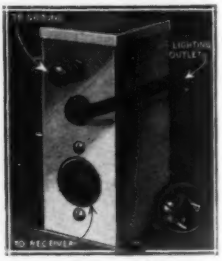


Grid Bias for Heater-Type A.C. Tube

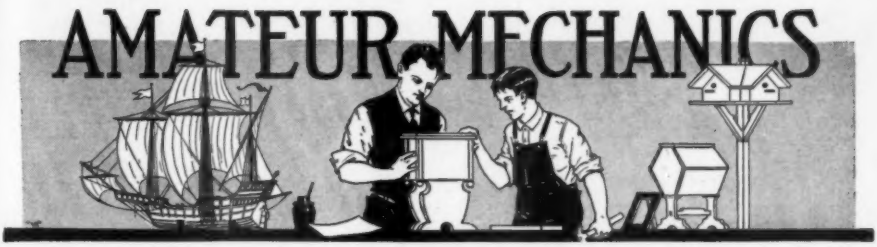
Because the cathode element of the type-327 a.c. tube is entirely apart from the heating filament, supplying a grid bias for these tubes is a very simple matter. All that is necessary is to connect the grid return of the transformer of the stage in which the tube is connected, to the B-negative lead of the power pack, and then connect the proper value of grid-bias resistor between the grid-return terminal of the transformer and the cathode K-terminal of the tube socket. The grid-bias resistor should be shunted by a by-pass condenser of at least 1 mfd. When several of these tubes are operated from the same filament winding, but the grid voltages required differ on the various tubes because of the stages in which they are used, merely connect separate grid-bias resistors in each stage, in the same manner.

Filter Prevents Power-Line Noises

An interference filter, to be connected between line and set and designed to prevent noises from the power line from affecting the operation of electric receivers or power-supply devices, is now available. The device is also useful to prevent radiation and interference from electric motors, electric refrigerators and sewing machines, oil burners and similar electrical appliances. It can be connected quickly by a novice.



¶Popular Mechanics' radio department offers its information service free to all readers of our magazine. We will be glad to help you with your problems, and will promptly answer all inquiries.



"Pepping Up" Old Outboard Motors

By DICK COLE

WHEN an automobile motor becomes sluggish and ignition and carburetor adjustments will not better the condition, the owner concludes that the valves require grinding and is usually correct in this conclusion. However, when a similar condition arises in an outboard motor, one must look for the cause of the trouble elsewhere, as these motors are of the two-cycle type and have no valves. Sluggishness, in this case, can almost invariably be traced to loss of compression in the crankcase.

In the two-cycle motor, the mixture from the carburetor is first drawn into the crankcase, compressed on the downward stroke of the piston or pistons, and is then injected through a port into the cylinder, displacing the previous charge. If the crankcase is not gas-tight, considerable power loss will be evident. A simple method of checking up the compression and to locate the points of leakage is shown in the drawings.

An old auto oil-pressure gauge, Fig. 1, obtained from a junk yard, has been found useful to test a one-cylinder motor. Two such gauges may be used in case of two-cylinder motors, although only one is necessary. Whether or not these gauges register accurately, the pound pressure per square inch is immaterial so long as they are capable of indicating a pressure of 50 to 60 lb. At some convenient and accessible point in the crankcase,

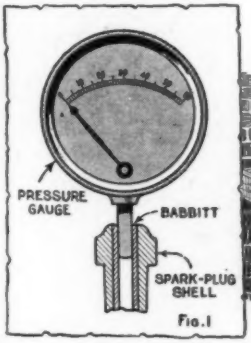
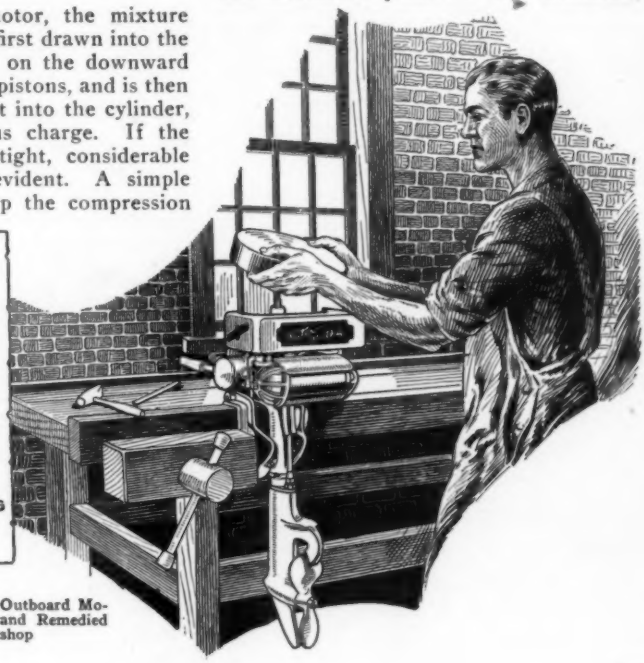
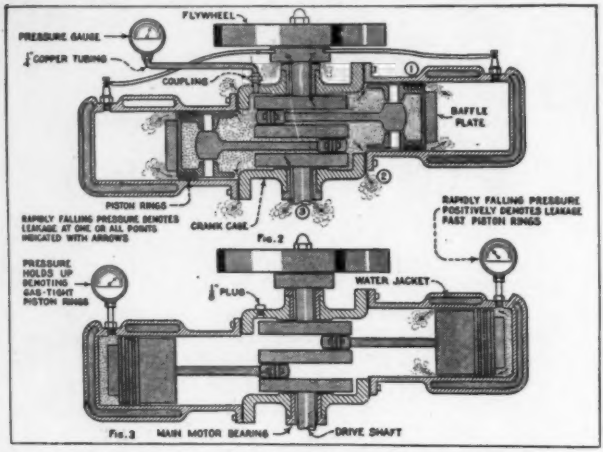


Fig. 1



Cause of Sluggishness of Old Outboard Motors Can Readily Be Found and Remedied in the Home Workshop

drill a hole and tap it for a ⅛-in. pipe fitting. (See Fig. 2.) A short piece of ¼-in. copper tubing and standard fittings are used to connect the pressure gauge with the crankcase as indicated. The flywheel is turned to bring the pistons against the crankcase compression, and the gauge reading is observed. If the pressure drops quickly—in two or three seconds—then the point of leakage must be located and remedied. The points where leakage can occur are at the piston rings, through a faulty cylinder-base gasket, and between the crankshaft and main motor bearings. To check up the possible loss at the piston rings, the body of an old spark plug is bushed to receive the pressure gauge, as shown in Fig. 1.



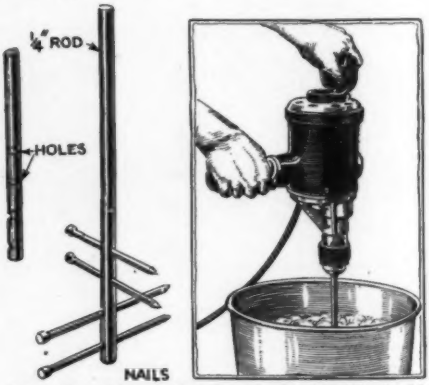
Old Auto Oil-Pressure Gauges Used for Checking Compression of Cylinder and Crankcase

In the case of a two-cylinder motor it is best to use two gauges, as indicated in Fig. 3, although the cylinders can be checked one at a time. The flywheel is turned to bring the pistons against the cylinder compression and the gauge readings noted. Rapidly falling pressure positively denotes leakage at the rings, as there is no other outlet for the gas, except on very rare occasions when a sand-hole may be found in the piston casting. If a cylinder does not hold compression, it should be removed, carefully checked for scoring and "out-of-roundness," and new pistons substituted. If there is no appreciable loss of compression in the cylinders, the motor should be run and oil squirted around the cylinder gasket. Bubbles will show a bad gasket. If there is no leakage at this point, it is obvious that the crankcase compression is lost between the crankshaft and the bearing. The remedy for this depends entirely on the design of the motor. If the crankcase and bearings are split along the center line of the crankshaft, the bearing shells can be shimmed and new bearing surfaces scraped. If the motor is equipped with roller bearings, there is always a gland which can be adjusted or packed with new packing.

Every outboard-motor owner should check up on the crankcase compression occasionally, and, if faulty, the cause should be located and remedied immediately, as loss of crankcase compression results in considerable fuel and power loss, and also contributes to difficult starting.

Electric Drill Used for Mixing Glue

For mixing large quantities of waterproof glue, an electric hand drill has been found useful. The stirring device, which is gripped in the chuck of the drill, con-



Large Quantities of Glue Can Be Quickly Mixed with the Aid of an Electric Hand Drill

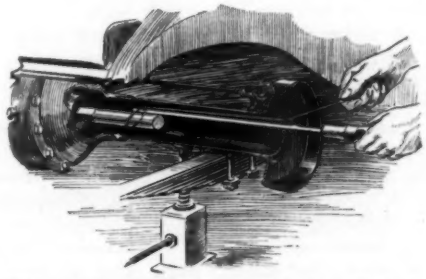
sists of a short piece of ¼-in. iron rod or steel. Two sets of slanting holes are drilled through the rod near one end, one pair being at right angles to the other, as shown in the drawing. The holes are spaced about ⅛ in. apart and should be of such size as to allow a snug fit for four small finishing nails, which are driven halfway through.—E. F. Kierman, Pasadena, Calif.

Improving Tone of Stringed Instruments

A felt pick will wear out, one of celluloid will break, but a leather pick will do neither. While giving a loud tone, it will not "clang" or "slap" like a celluloid pick. Cut it out of a pliable piece of boot leather with a pair of shears. Such a pick will last indefinitely. The tone quality of a tenor guitar or tenor banjo can be greatly enhanced by doubling each string as on a mandolin. To do this, it is necessary to drill four extra holes in the head and insert pegs. Effective melody and harmony may then be executed on the two double strings only, making the playing much easier. By inserting an ordinary door key under the strings near the nut of a tenor guitar or ukulele having steel strings, it can be played like a Hawaiian guitar. The back of a knife blade makes a good steel. A tenor banjo or a banjo uke may be played this way also. I have tried out all of these ideas and found them entirely satisfactory.—Kenneth R. Deardorf, Bemidji, Minn.

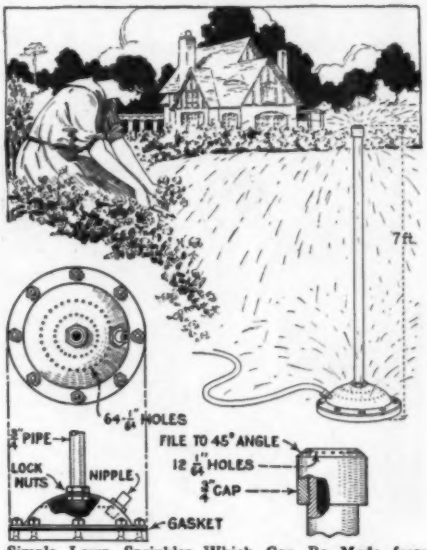
Fishing Rod Aids in Removing Broken Parts of Axle

On three occasions I have used a telescoping fishing rod and a small soft-iron wire, looped as shown, to remove inner portions of broken axles without removing the opposite axle to punch the broken piece out. The illustration clearly shows how it is done, and the kink is quite a timesaver. —S. O. Stanfield, Maymont, Can.



Fishing Rod and Wire Loop Enable Auto Mechanic to Remove Part of Broken Axle

Homemade Lawn Sprinkler



Simple Lawn Sprinkler Which Can Be Made from Pipe and Fittings

A differential-housing cover plate from a junked automobile makes a suitable base for a lawn sprinkler, as shown in the illustration. A hole is drilled in the center of the case for a 7-ft. length of ¾-in. pipe, which is inserted in it and held in place with two ¾-in. pipe nuts. A round base of wood is bolted to the flange of the case, and a ¾-in. cap, with the edge turned to a 45° angle, is fitted to the top of the vertical length of pipe. A number of 1/64-in. holes are drilled in the cap and in the base as shown. A suitable nipple, to accommodate a hose, is fitted to the filler hole in the case, and for this purpose a reducing bushing may be found necessary. The sprinkler is shown in its simplest form, but the design can, of course, be varied to suit the user. A horizontal arm can be screwed onto the vertical length and drilled with 1/64-in. holes or a whirling sprinkler can be provided at the top, if desired.

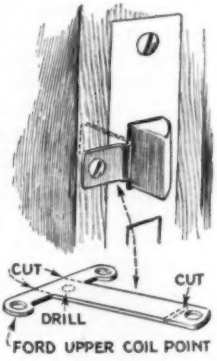
Vacuum Cleaner Supplies Air for Soldering Torch

An efficient soldering torch, using ordinary gas, acetylene gas or vaporized gasoline, can be made by the amateur mechanic at a very small cost. It can be used for doing almost any job of soldering or brazing. A vacuum cleaner is rigged to supply air. The torch consists of a 3-in. length of ¼-in. brass tubing. Thread one end and screw it into the single end of a Y-fitting. The two Y-openings are fitted with ¼-in. brass 45° elbows, adjusted so that their ends are parallel. Apply red lead to the joints and turn them up tight. Lengths of tight-fitting heavy-duty rubber tubing are slipped over short nipples screwed into the elbows. One tube is connected to a ¼-in. shut-off cock in the gas line, and the other to a similar cock in the air line. Remove the bayonet fixture that holds the bag to the housing of the vacuum cleaner, and make a similar fixture of heavy sheet metal. It must be a snug fit so that no air will escape between it and the socket. To the front of this, braze or solder a steel plate. If the fixture has a thick rim, the plate can be fastened to it by small machine screws, the rim being drilled and tapped for this purpose. Drill a hole in the center of the plate and braze in a 6-in. length of ¼-in. pipe. This is attached to the air-line valve by means of a suitable length of rubber tubing. Wire-clad tubing is the best for the pressure line, as it will not break under excessive strain. To use the torch, turn on the gas slowly and light it at the nozzle. Then turn on the air pressure, also slowly, until the flame is almost invisible. This is the hottest flame that can be obtained. The size and intensity of the flame can be regulated by adjusting the nozzles. The air pressure depends on the capacity of the vacuum cleaner. Place the cleaner where it will rest solidly while running, and in such a position that the switch can readily be reached. Do not start until ready for air, and turn it off just as soon as the flame is turned off.—L. B. Robbins, Harwich, Mass.

Gas Soldering Torch, Supplied with Air from Old Vacuum Cleaner, Produces Intense Heat
½" RUBBER HOSE FROM VACUUM CLEANER
½" BRASS PIPE FITTINGS
½" RUBBER HOSE FROM GAS MAIN
¼" PIPE
FIXTURE FROM BAG
RUBBER GASKET
BRASS DISK

Repair Spacer for Door-Catch Bolt

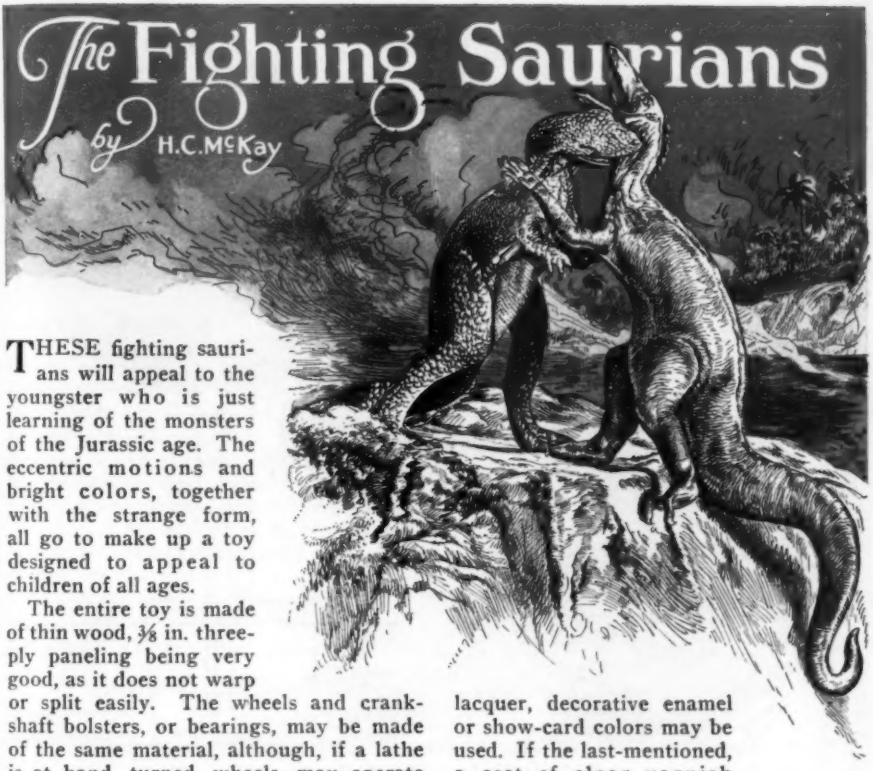
Closed Ford cars, before the last two models, are equipped with a sliding catch bolt which moves in and out like the bolts on ordinary doors in buildings. The sliding bolt presses against the outer side of the opening in the door catch when the door is being closed, and wears the opening larger. The door must then be pulled much farther in to catch it, which necessitates hard slamming. A repair spacer can be made from a Ford upper coil point to take up the wear and hold the bolt farther in. The coil point is cut and bent as shown, and is attached to the edge of the door with a small wood screw, with one side of the angle fitting into the lock opening alongside the catch bolt. A few of the cars using the sliding door bolt may have had steel-frame doors, in which the wood screw could not be used, and a hole would have to be drilled and tapped for a small machine screw or stovebolt to hold the spacer in place.



¶To make brilliantine, mix castor oil, one part, olive oil, two parts, and eau de Cologne, four parts.

The Fighting Saurians

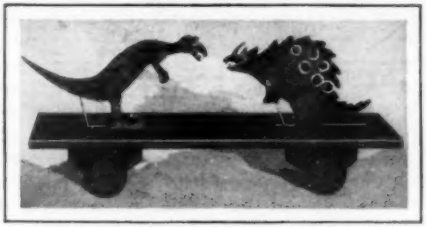
by H.C. McKay



THESE fighting saurians will appeal to the youngster who is just learning of the monsters of the Jurassic age. The eccentric motions and bright colors, together with the strange form, all go to make up a toy designed to appeal to children of all ages.

The entire toy is made of thin wood, ⅜ in. three-ply paneling being very good, as it does not warp or split easily. The wheels and crankshaft bolsters, or bearings, may be made of the same material, although, if a lathe is at hand, turned wheels may operate more smoothly. If the paneling is used for the bolsters, two thicknesses should be used, giving each bolster a ¾-in. bearing surface.

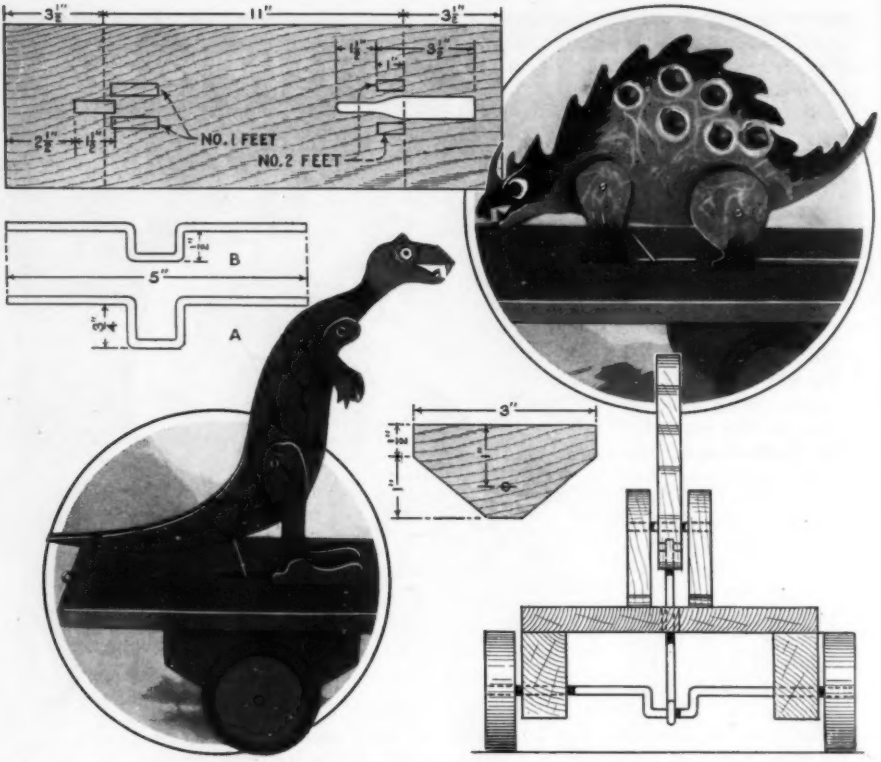
The first step is to fretsaw the two saurians No. 1 and No. 2. It will be noticed that these outlined figures are not separated into individual members, but the whole is given in one figure. By the use of the guide lines, however, the legs may be drawn separately, while the figures give a good idea of the assembly. In both cases, one body and two pairs of legs will be needed.



As the most important point is to have all joints work smoothly, the decorating is best done before assembly. For this purpose, either lacquer, decorative enamel or show-card colors may be used. If the last-mentioned, a coat of clear varnish should be applied later as these colors are not waterproof and are inclined to rub off when dry.

The exact coloration is left to individual fancy, as we have no means of knowing what colors these reptiles actually were. With our present knowledge of protective coloration and of the blotchy patterns of many present-day reptiles, we may assume that the abdomen was a yellowish-green, or greenish-yellow, with a varicolored and blotched pattern on the back and sides. The drawings indicate the colors given the original models.

The next step is to make the carriage. The bed measures 5 by 18 in. and is cut out as shown. The opening between the feet of No. 1



(the taller figure) measures about 3/16 in. wide, but as this opening is for the wire drive rod to pass through, the width need not be exact. The opening for No. 2 is quite different. The larger end of the opening allows the tail to drop below the level of the bed when the animal rises. This opening is ½ in. wide. The narrow end is for the No. 2 drive rod and is about 3/16 in. wide. If the figures are drawn exactly as shown and placed upon the bed as indicated, they will work, but before fastening them, it would be well to make a trial to see that all action is smooth.

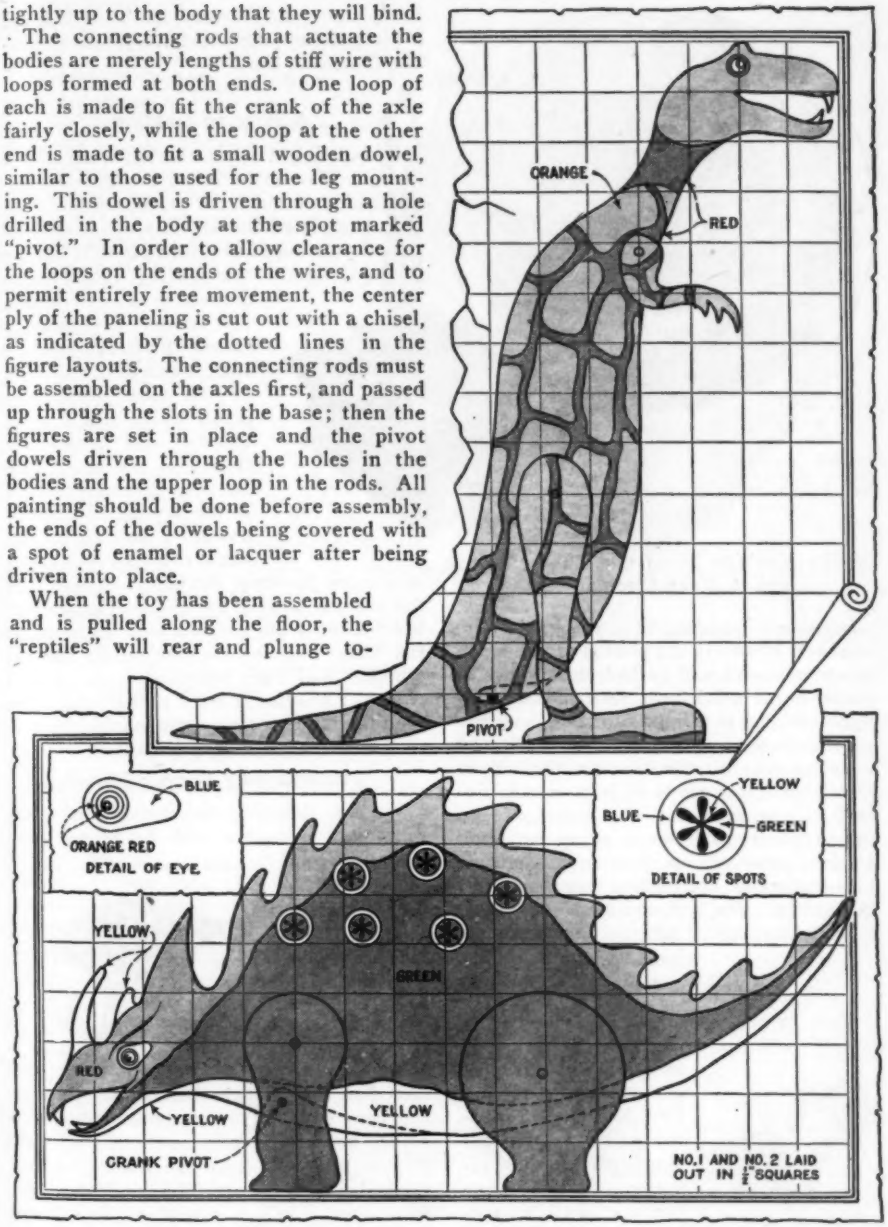
The bolsters, four in number, are made as shown in the detail; of the two cranks, made of stiff wire, A is for No. 1 drive and B for No. 2. Note that these cranks are made for use with 2-in. wheels. Mount the bolsters on the sides of the carriage with a 2-in. space between the end of the bolster and the end of the carriage. This places the axle (crank) line 3½ in. from the end. The holes through the bolsters should be from 1/64 to 1/32 in. larger than the diameter of the crank wire. The holes in the wheels are about 1/64 in. smaller than the crank wire, requiring a drive fit. This gives the propelling traction.

The legs are assembled with the bodies by means of small wooden dowels. For this purpose, the small wooden sticks upon which lollypops are mounted will serve excellently. The holes drilled through the bodies are a trifle larger than the sticks, while the holes in the legs and arms are drilled so as to be a drive fit. This gives a firm support, while permitting free movement. The two arms of No. 1 may be glued solidly to the body if the maker prefers, but the movement is more natural if they are permitted to swing free. When attaching the legs to the body, it is an improvement to slip a small washer over the dowel, on each side, before driving on the leg or arm, although this is not essential. If washers are not used, be careful not to drive the limbs so

tightly up to the body that they will bind.

The connecting rods that actuate the bodies are merely lengths of stiff wire with loops formed at both ends. One loop of each is made to fit the crank of the axle fairly closely, while the loop at the other end is made to fit a small wooden dowel, similar to those used for the leg mounting. This dowel is driven through a hole drilled in the body at the spot marked "pivot." In order to allow clearance for the loops on the ends of the wires, and to permit entirely free movement, the center ply of the paneling is cut out with a chisel, as indicated by the dotted lines in the figure layouts. The connecting rods must be assembled on the axles first, and passed up through the slots in the base; then the figures are set in place and the pivot dowels driven through the holes in the bodies and the upper loop in the rods. All painting should be done before assembly, the ends of the dowels being covered with a spot of enamel or lacquer after being driven into place.

When the toy has been assembled and is pulled along the floor, the "reptiles" will rear and plunge toward each other with a swinging motion. The weight and method of pivoting No. 2 will cause a certain amount of slip which gives it an awkward, shambling, irregular motion that is much more realistic than would be a uniform up-and-down motion.



An Old Sewing-Machine Head and a ¼-Hp. Electric Motor Were Used to Make This Handy Circular Saw

Sewing-Machine Head and Small Motor Used to Make Circular Saw

Capable of cutting 2-in. stock, the circular saw shown in the photos can be made by anyone, and will be found very useful in the home workshop. An old sewing-machine head is used, a 6 or 8-in. saw being attached to one end of the shaft and a pulley of suitable size to the other. The table top is made of 1-in. wood, pivoted at one end, and the ripping fence and crosscut guide from scrap material. A ¼-hp. motor is used to supply power. This outfit cost the builder less than $8.50 and answers the purpose excellently.—R. E. Hill, Pasadena, Calif.

Homemade Eardrums

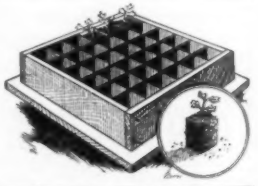
I am rather hard of hearing and after carefully examining some small eardrums on the market, decided to make some myself. For 15 cents I purchased two rubber ear plugs used by swimmers. These were hollow and cone-shaped, as shown in the drawing. I drilled a small hole straight through the apex of each, as indicated, which made them ready for use. I found them highly satisfactory, as they did assist me in hearing much better.—James E. Noble, Toronto, Can.

A Hint on Sodding

In building a terrace at the front of his lawn, a Wisconsin home owner obtained quantities of sod from various places and thus completed the job in a much shorter time than would have been possible had he grown the grass from seeding. However, in the course of a few weeks, the terrace presented a rather mottled appearance; some of the patches of sod were fresh and green while others were brown and apparently dead. As the same care had been given all the sod in the laying, the owner was at a loss to understand the reason until a landscape gardener explained to him that the sod containing the thriving grass had been taken from ground long exposed to the direct rays of the sun, while the remainder had been removed from shaded places. The change from shelter was more than the tender grass could stand.

Transplanting Tomato Plants

For transplanting tomato seedlings, the illustrated container will be found convenient. It consists of a wooden frame just large enough to accommodate a paper egg-crate filler. The bottom should not be nailed to the sides, as this would prevent the easy removal of the sides when the plants are to be taken out. Good, rich dirt is first put into the compartments formed by the paper filler, and the seed is planted. When the plants are large enough to be transferred to the ground, the sides of the box are slipped off, and the plants can then be removed one by one.—W. O. Hendrickson, Argyle, Wis.

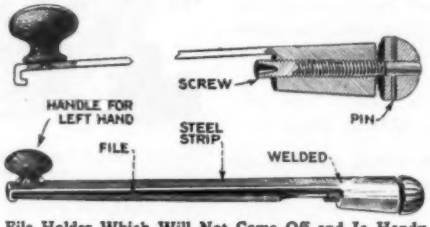


Use of Slow Paper When Enlarging Photos

Amateur photographers who do their enlarging at home may find it possible to use slower paper than the regular kind offered for the purpose by increasing the intensity of the light used. This can be done by "overrunning" the electric lamp for a short period of time, that is, forcing through it a slightly higher voltage than that for which it is rated. A 250-watt lamp designed for a 110-volt circuit can be used on a 220-volt circuit if a suitable resistance is connected in series with it. Then by short-circuiting the resistance for a few seconds an enormous brilliancy is obtained. Of course, some lamps will burn out when subjected to a voltage twice their normal rating, but generally the lamp will last through the ordeal, although its life will be shortened. By this method the average exposure of an enlargement is reduced to almost one-thirtieth of the time previously consumed.

Handy File Holder

One of the most used and abused tools is a file, and it is often found without a handle. The holder shown in the illustration will not come off and is much handier to use than the usual type. It consists of a length of flat iron, bent at one end to form a hook which is caught over the end of the file, and the other end of the iron strip is welded to a tapered piece of steel, as indicated. The latter is tapped lengthwise for a screw, which is anchored in a small wooden knob, and a hole is drilled in the other end of the screw to accommodate the pointed tang of the file. In use, the file is slipped into the holder, and the wooden knob is turned until the file is held securely.



File Holder Which Will Not Come Off and Is Handy to Use

Strips of Ordinary Adhesive Tape Used as Stencil When Painting Furniture

Tape Used for Decorating Furniture

Many home owners purchase unpainted furniture because they wish to paint and decorate it themselves to match the color and carry out the design details of the room decoration. Adhesive tape has been found very useful as a stencil for blocking out parts not to be painted. Care must, of course, be taken to press the edge of the tape securely on the surface to be blocked out, in order to prevent paint from running under it. Quick-drying lacquer is most convenient for this work.

Oiling Lock Wheel on Ford

When a lock wheel is installed on a Ford, and is locked in place, the gears, shaft and bushing on the inside of the steering-gear case often run dry of grease. A squeak will result. If a small hole is drilled in the case, to admit an oilcan spout, this trouble is easily overcome.

Simple Guide Strip Holds Prints Flat While They Are Being Trimmed

Guide Helps Trim Curled Prints

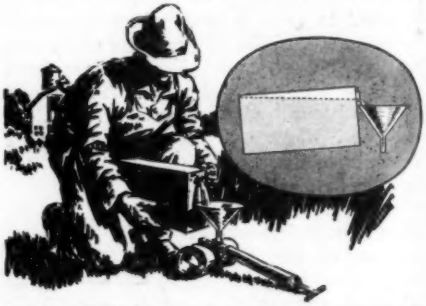
Curled prints are hard to trim unless held down flat with a ruler or otherwise. To do away with this difficulty, I devised the guide shown in the photo. It consists of a strip of wood, ¾ in. wide and ¼ in. thick, which is fastened to the ends of the trimming board with thin brass springs, so made that the guide is automatically raised about ⅛ in. when released. The clips are tacked to the guide on the top, the ends below being free. The inside of the guide is beveled to facilitate the introduction of the prints under it. The slightest pressure on the guide will flatten the print and the guide does not interfere with the trimmer.—J. G. Pratt, Washington, D. C.

Repair for Leaky Water Pipe

Here is an easy and cheap method of repairing a leaky lead water pipe: Get two galvanized unions, file off the washer flanges and ream out the holes inside so that they can be forced over the pipe. Then saw out the bad part of the pipe and screw one-half of the first union onto one end of the pipe, and the other half onto the other end, letting the lead pipe come through about ¼ in., which can be flanged like a washer and filed smooth. Take a piece of old lead pipe, still in good condition, and cut it about 1 in. longer than the distance between the unions already fitted. Screw the two parts of the second union onto this piece and flange both ends in the same way as before, being careful to have the flanges fit nicely together. Place a thin pasteboard washer in both of the unions, and screw them up tight. The result will be a rustless water-tight job, which will be much stronger than a wiped joint. I have made a number of repairs in this way, and every one of them has been found satisfactory.—John Kuhhorn, Bronx, N. Y.

Saving Liquid When Pouring

Spilling liquid when pouring it can be prevented by holding the can as shown in the drawing, and providing a suitable funnel. Instead of holding the can with the opening on the lower side, which seems to be the most natural way of doing it, turn it so that the opening is at the top. Set the ridge around the opening over the edge of the funnel, and proceed to pour out the liquid slowly. This method admits air through the opening to replace the liquid removed, and permits a steady flow without spilling.—Luther Strosnider, Onaga, Kans.



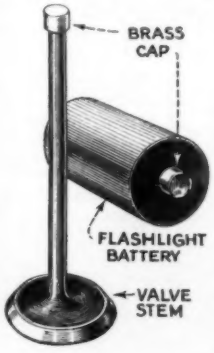
Pouring Liquid from a Can So That It Flows Evenly and Will Not Spill

Preventing Quick Decay of Fruit

Ripe fruit, which spoils quickly during the hot months if not kept in a refrigerator, can be kept fresh for several weeks without the use of any ice whatsoever, by storing it inside of a cleaned-out squash, pumpkin, watermelon or similar large fruit. The top of the squash is cut off, the insides thoroughly cleaned out and the fruit is placed inside, care being taken to prevent bruising the fruit. Replace the top and set away in the cellar. Fruit so stored will be fit to eat after several weeks, whereas it would have spoiled in a few days if left in the open.—James E. Noble, Toronto, Can.

How to Silence Ford Valves

As no provision is made for adjusting the valves of a Ford motor, they usually become quite noisy. By taking the small brass ferrule off the top of the carbon of a discarded flashlight battery of standard size, it will be found that this fits nicely on the end of the valve stem. Stick one on each valve stem and tap it down gently with a hammer. If the ferrules do not take up enough of the play, build up the thickness of the end by inserting small disks of shim brass inside of the ferrules. The disks can be punched out with a piece of tubing ground to a sharp edge. The ferrules will not only stop the noise, as the brass is soft and serves as a cushion, but oil runs into them, providing additional cushioning.—C. M. Mahood, Warren, Pa.



Ash Receiver for the Auto Driver Is Emptied through Chute

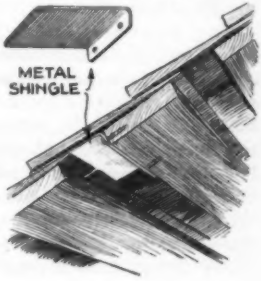
Many autoists will find the illustrated ash chute, which empties outside of the car, a real improvement over the ordinary ash receiver which is mounted on the dash or in any other position near the driver.

Length of Conduit and Fittings Make Handy Ash Chute for the Auto

It consists of a length of conduit, about 15 in. long, and a fitting of the type indicated. A hole, large enough to receive the conduit, is drilled in the floorboard just behind the position of the shifting lever, and the conduit is then fastened by means of a floor flange and a locknut. The installation of such a chute will take only a few minutes' time and anyone can easily do it.

Easy Method of Patching Shingle Roof

While looking after some electric wiring in my attic, I noticed a small hole in the roof where the water was leaking through. The roof was high and steep, so I devised a simple method of repairing the leak from the inside. I cut a piece of galvanized sheet iron, about 4 by 6 in. in dimensions, and bent one edge at right angles as indicated. It was an easy matter to work this piece between the shingles to cover the leak, and tack the bent edge to the roof board above the leak.—S. E. Schofield, Indianapolis, Indiana.



You Can Learn

JUGGLING, whether it be the manipulation of balls, the spinning of plates, or the balancing of billiard cues, is one of the most healthful pastime-sports in the world, training the eyes and developing the muscles to a degree of co-ordination almost impossible to attain in any other art.

The beginner in juggling invariably starts with balancing effects, as these are the easiest to acquire. For the first lesson, nothing is better than a common broom handle, about 4 ft. long. Practice with this until you can balance it on the back of either hand with scarcely any visible motion, and then try a similar balance on the forehead, the nose and the chin, as shown in Fig. 1. Keep your eyes on the top of the pole, as indicated by the dotted line, so that you can immediately detect any tendency to fall and correct it at once.

Once some degree of skill is acquired, you can go on to more showy effects in this branch of juggling. One of the best of these is the bottles-plate-glasses balance in Fig. 2. In performing this effect, the first bottle is balanced on the forehead or the chin. Then an assistant hands you the plate, which is set on top of the bottle. The second bottle is then set in place, followed by the four glasses, set equidistantly around the uppermost bottle. The lower bottle should be fitted with a cork, cut off flush with the glass, so that it will get a firmer grip on the flesh, and a round piece of cloth should be pasted to both the top and the bottom center of the plate in order to keep the bottles from slipping.

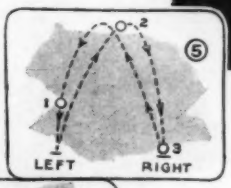
Other excellent effects, such as the balancing of a burning cone of tissue paper, as shown in Fig. 3, and the umbrella-hat balance shown in Fig. 4 can be easily mastered once you have developed the

to Juggle

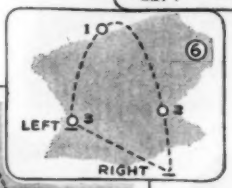
by K.H. Ward

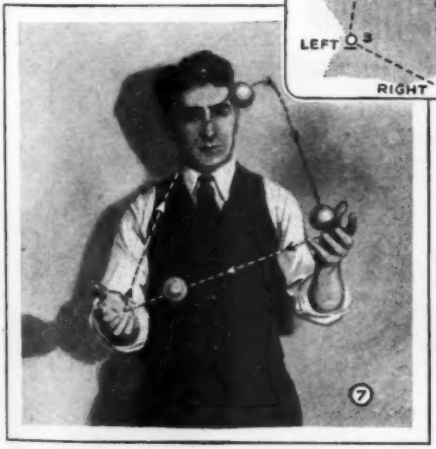
initial technique with the broom handle. The tissue paper is pulled out stiff, before balancing; the hat is easiest balanced just where the nose meets the forehead.

Ball juggling is equally popular. There is something strangely fascinating in juggling three balls, then four, five, six, seven—where does it all end? For a beginning, however, two are sufficient. These can be of almost any variety—tennis balls or small rubber balls do very nicely. Hold both balls in the right hand. Toss one of these into the air about 5 ft., and, when it is just about to descend, shoot the other ball up after it. When the first ball comes down it is immediately sent up in the air again. Practice the same manipulation with the left hand until it becomes almost mechanical.



Next comes the three-ball juggles. There are many ways in which three balls can be manipulated, but the "cascade" and the "shower" are the two forms most suited to the beginner. First try the cascade, which is shown in the diagram, Fig. 5. To commence, take two balls in your right hand and one in your left. Toss ball No. 1 upward from the right hand, with a slight inward motion. As ball No. 1 is about to descend, ball No. 2 (left hand) is thrown into the air. As ball No. 1 comes down in the left hand, ball No. 3 (right hand) should just be starting its upward flight. Do not throw the balls too high, 5 or 6 ft. is the limit. If you count each ball as you throw it into the air, you will find the going much easier.





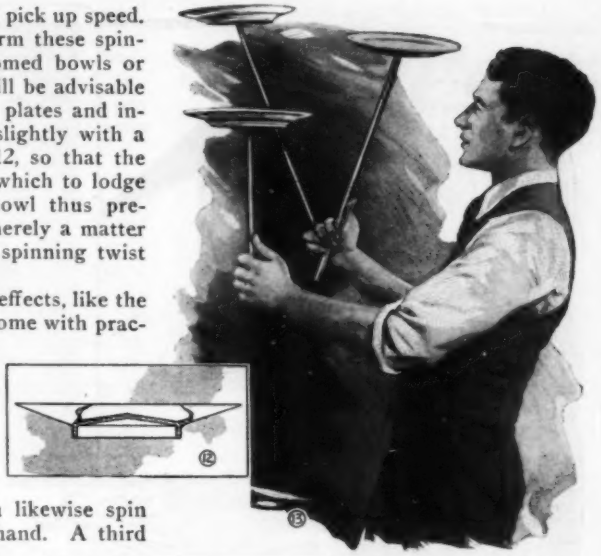
"Showering" three balls is a little more difficult. Start with two balls in the right hand and one in the left. The left hand should be held a bit higher than the right, as shown in Figs. 6 and 7. Start by throwing ball No. 1 from the right hand. This first ball should be thrown slightly higher than the rest in order to get the movement under way. Immediately the first ball is in the air, ball No. 2 (right

hand) is thrown up after it. Ball No. 3 (left hand) is then shot down to the empty right hand. As ball No. 1 is caught in the left hand, ball No. 3 should be leaving the right. Stick to the three-ball juggling until you can do it almost without thinking. To juggle four balls, you merely juggle two in each hand. Cascading five balls, as shown in Fig. 8, comes quite easily after you can do the three-ball juggles to perfection.

Another fascinating branch of juggling is plate spinning. For this you will need a number of metal plates, bowls or pie pans, as well as two or three spinning sticks cut from round wood stock and tapered to a round smooth point. To commence, you hold the stick and the plate in your right hand, as shown in Fig. 9. Then the arm is raised quickly to throw the plate into the air and a rapid, right-hand twist, imparted by thrusting the thumb away from the body, is given to the plate, as shown in Fig. 10. The stick is lifted to catch the plate in its descent, as shown in Fig. 11. Simultaneously with the fall of the plate, the point of the stick is rotated or given a circular motion in the same direction as the plate is spinning, the stick being moved more and more

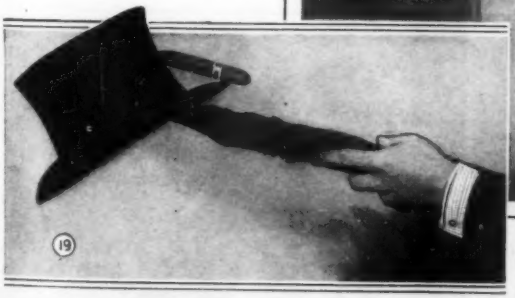
Above, Juggling with Five Balls; Below, the Three Steps in Plate Spinning; the First Position; Imparting the Spin to the Plate, and the Plate Being Kept in Motion by Rotating the Stick

rapidly so that the plate will pick up speed. Very skilled jugglers perform these spinning effects with flat-bottomed bowls or pans, but in your case it will be advisable to procure enameled metal plates and indent the bottom of these slightly with a punch, as shown in Fig. 12, so that the stick will have a recess in which to lodge itself. With a plate or bowl thus prepared, the trick becomes merely a matter of giving the plate a good spinning twist as it leaves your hand.

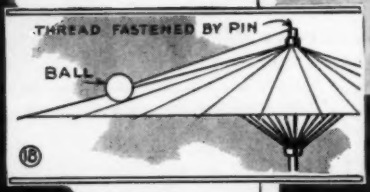


Advanced plate-spinning effects, like the one shown in Fig. 13, will come with practice. In this number, the first plate is set spinning with the right hand in the manner described. It is then transferred to the left hand. An assistant hands you a second plate and stick which you likewise spin and transfer to your left hand. A third plate can then be spun with the right hand or two or three balls may be juggled in that hand, if desired—after you have practiced enough.

An excellent bit of comedy in connection with plate juggling is to apparently drop the plate, as shown in Figs. 14, 15 and 16, and then recover it just



before it reaches the floor. The trick is a "catchy" little thing, but not at all difficult. You should bend your right arm, holding it close to your body, and rest the plate on the arm, as shown. Now, by extending the arm, the plate will fall, but the right hand will be exactly behind it. The right hand continues to stay behind the plate for its entire journey, so that when the plate has almost reached the floor you need only lift the hand slightly to be in a position to catch the plate. To the audience it appears as if the juggler stooped down at exactly the critical moment; another second, apparently, and he would have been too late. Better use metal plates for this trick.



Above, Making a Ball Run around the Edge of a Parasol Is Easy When You Know the Trick; Figs. 14 to 16, a Tragedy Averted, or, the Dropped-Plate Trick, an Effective Comedy Interlude; There Is No Danger to the Plate, Once the Trick Is Mastered, but It Is Well to Use an Enameled Metal Plate at First

An easy bit of jugglery, and one used by many performers, consists in lighting a match on a matchbox which has been thrown into the air. It is performed simply by covering the matchbox entirely with coarse sandpaper, so that, no matter which side the match strikes, it will light. The box, of course, is colored to resemble an ordinary box of matches. Use a full box of matches, as the additional weight makes for easier lighting.

Another simple juggle is to make a light ball run around the edge of an opened parasol, as shown in Fig. 17. It is performed by attaching a thread between the ball and a pin which slips into the end of the parasol, as shown in Fig. 18.

But, to get back to legitimate juggling, how about the "Hat and Cigar" trick? Every juggler must be able to do that. It is accomplished by placing a silk hat on the end of an umbrella, and a cigar on the hat, as shown in Fig. 19. The stick is then lifted upward so that the hat and cigar are catapulted into the air. The hat is then caught on the head and the cigar in the mouth, as shown in Fig. 20.

The properties for the effect are, of course, the hat and the umbrella, together with a cigar, about 5 in. long, turned from soft wood and circled with a regulation band. The hat, by the way, can be a derby or a good felt hat instead of the "topper," if desired.

In the performance of the effect, the umbrella should be held at about the middle, and the hat and cigar thrown off the end with an easy upward movement. Both the hat and the cigar make but one complete revolution. It is best to practice catching the cigar in the mouth first, as this is the most difficult part of the trick. When the cigar can be caught fairly often, then practice catching the hat at the same time. It is easier to catch the hat on the back of the head, as there will be a fraction of a second longer between the two parts which compose the trick.

Auto Used for Hulling Walnuts

The photo shows how a Missouri farmer hulls walnuts with the aid of his car. A

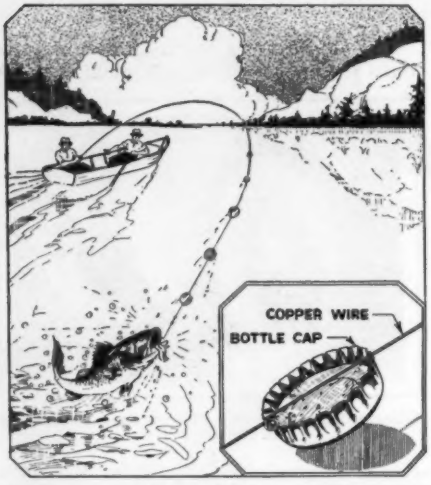
Missouri Farmer Showing How Walnuts Are Hulled with the Aid of a Car

wooden trough, slightly wider than the tire, is provided under the rear wheel. The trough is open at both ends and the bottom board is long enough to extend under the front wheel, which holds the trough in place and prevents it from being dislodged. The rear wheel is raised a little by jacking up the axle, and after the engine is started the car is put in gear. The walnuts are fed under the front side of the wheel and as they are caught by the tire and are pushed out at the rear, the green hulls are entirely removed.—Uriel B. Stokes, Denver, Colo.

Removing Single Sheets of Photographic Paper from Box

Photographers who handle a large quantity of paper often have difficulty in removing single sheets from the box. A simple method of overcoming this trouble is shown in the photo. A strip of strong paper is fastened to one end of the box, and run along the bottom loosely, the free end being allowed to project. By pulling this end, the paper is lifted so that single sheets can be handled easily.

Strip of Strong Paper Helps Photographers to Get at Single Sheets

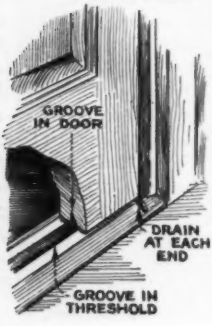


Trolling Lure Made from Old Bottle Caps Proves Effective for Catching Lake Trout

Old Bottle Caps Help Catch Fish

Some time ago the writer, equipped with flies for brook-trout fishing only, camped on the shore of an isolated lake that promised excellent fishing for lake trout. Not having suitable trolling tackle, a gear was made from old bottle caps, discarded by previous campers. The caps were polished in sand and were then attached to a length of copper wire, as shown in the detail. This gear did not rotate and therefore a swivel joint was not needed. The caps had a rapid fluttering movement when drawn through the water. This simple outfit was an effective fish catcher, equal in results to expensive lure.—Dick Cole, Los Angeles, Calif.

Drain under Outside Door



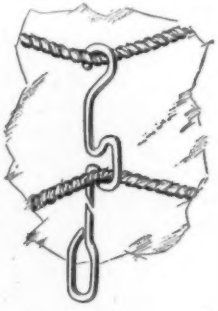
Water driven by a strong wind often enters the house under an outside door. This can be prevented by cutting a ¼-in. groove in the threshold, lengthwise, as shown in the drawing. Two notches, at right angles to the grooves, allow any water accumulated in it to run off on the outside. The groove should be V-shaped so that it can be kept clean by merely sweeping it with a broom. A similar groove is cut in the underside of the door, directly opposite that in the threshold to lead water running down the outside of the door into the groove. If this is not done, the water will creep along the underside of the door and will drop off on the inside.—Adolph Rieter, Marinette, Wisconsin.

Substitute for Night Lamp Made from Water Tumbler

When a candle or a night lamp is needed but is unavailable, a satisfactory substitute can readily be made by nearly filling an ordinary tumbler with water and adding a couple of tablespoonfuls of salad oil, which will float on the water. Take some cotton batting and form a small flat wad with a wicklike projection in the center. Lay this carefully on the surface of the liquid and, as soon as the oil has been drawn into it, light it, and you will find that it gives a small flame, which will last for several hours.

Simple Clothesline Tightener

Endless clotheslines of the kind running on pulleys have the tendency to become slack so that the clothes hang low and drag on the ground. A pole is sometimes used to prevent this, but is not always satisfactory. The simple device shown in the drawing will be found much better. It consists of a length of heavy galvanized-iron wire, bent to the shape shown and hooked over both lines, making it impossible for the wind to separate them. The handle may be made of any desired length so that it will be handy for the user. Placed in the center of the line, this device will keep the clothes above the ground.—John L. Love, Toronto, Can.



Spare Automobile Tire Supplies Compressed Air for Campers

Increasing use of air mattresses, pontoon-type boats, and other rubber goods that have to be filled with compressed air, makes an available supply of compressed air highly desirable to the camper to eliminate the need of a pump. The spare tire can be overinflated from 50 to 100 per cent without injury when it is not in use, and the extra air can be applied to inflating the mattresses, etc. If the tire is needed, the pressure can readily be reduced by letting out some of the air. It will be found convenient to use a piece of rubber tubing, one end being fitted with a connection which is adaptable to the tire-valve stem—the kind that depresses the valve when pushed or screwed on. The connection on the other end of the hose should be adaptable to the valve of the article to be inflated, and the operation takes only a few seconds in this way. Obviously, it is much easier to get your supply of compressed air from this source than to use a hand pump. When the camper "hits the road" again, he refills the spare tire.

Straightening Fine Wire

When it is necessary to straighten fine wire, a practical method, which is appli cable in most cases, is shown in the photo. Tap the head of a fine-threaded stovebolt down halfway into a block of soft wood. Lay the wire on the wood under the bolt as shown, and press down firmly on the screw with the whole ball of the thumb. The bolt will not move as the other hand draws the wire through the vee of one of the threads. The thread provides a groove for the wire, straightening it with little or no jerk.—Frank W. Bentley, Jr., Missouri Valley, Iowa.

Using a Stovebolt and a Piece of Wood for Straightening Fine Wire

Simple Method of Using Auto Jacks for Raising Fence Posts Out of the Ground

Auto Jacks for Removing Fence Posts

Old fence posts can easily be removed without digging by using auto jacks as shown. A 2½-in. hole is bored through the center of the post about 1 ft. above the surface of the ground. An iron rod or length of heavy pipe is slipped through the hole, and the two jacks are set up under the ends of the rod. The post can be raised out of the soil by merely operating the jacks.

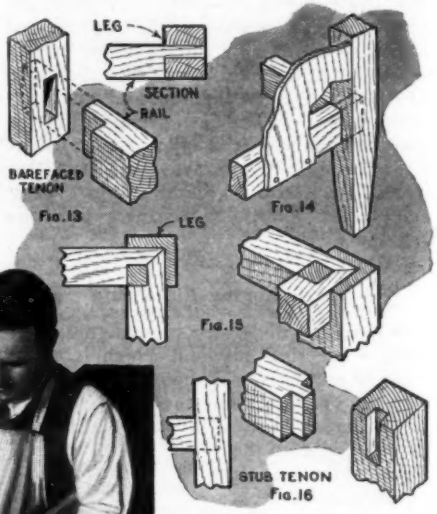
Tee Tip for Golfers

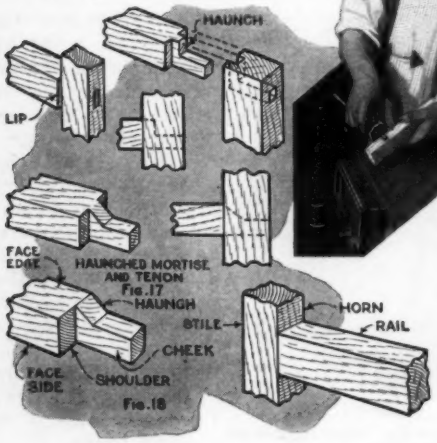
Tie a number of different-size tees at regular intervals along a piece of strong twine. This will do away with the need of hunting through your pockets for the tee you wish to use, and it is only necessary to pull the string out, select the tee, and proceed with the drive. An additional advantage is that the weight of the extra tees prevents the tee in use from being driven more than a few feet; consequently it is easily found.

Wood Joints for the Amateur

THE MORTISE and tenon joint probably is the most important one in woodworking, and no craftsman's education is complete until he has learned to make it well. The name mortise-and-tenon joint is applied to the method of joining two pieces of wood by forming a solid rectangular projection on one piece, and a corresponding cavity in the adjoining piece adapted to receive this projection. In other words, a rectangular end on one piece fits into a rectangular hole in the other, the projection being the tenon and the hole the mortise.

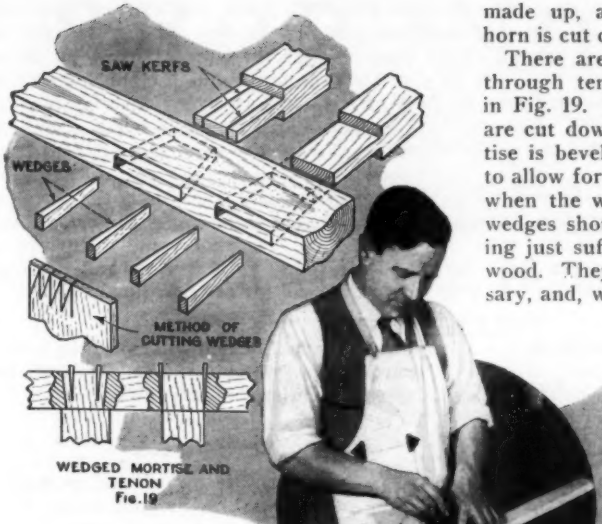
Before dealing with the way in which the parts of the joint are cut and fitted, it is well to know something of the various forms that the joint may assume. There are all kinds of mortise-and-tenon joints, each adapted to some particular purpose in construction. The simplest is the so-called barefaced tenon shown in Fig. 13. This has a single shoulder, and is usually employed only for framing on the interior of work. It will be noticed that the piece that carries the tenon is not so thick as the piece in which the mortise is cut, and that consequently the joint is flush on one side only. If used on a cabinet that is to be covered on the back with paneling, the flush side is made toward the interior of the cabinet, and the panel, as may be seen in Fig. 14, fills up the space left between the plain side of the rail and the leg. It is obvious that the thickness of leg and rail may be proportioned so that the panel may either be flush with the leg or slightly sunk below it. If paneling is to be used on both sides and back, and if barefaced tenons are used on the side rails as well as the back, the mortises are not carried completely through the leg, and the ends of the tenons are cut off at 45°, as shown in Fig. 15. This form of tenon, which does not go through the leg, is a "stub" tenon, as distinguished from a "through" tenon, which does go through the leg or other member of the frame.





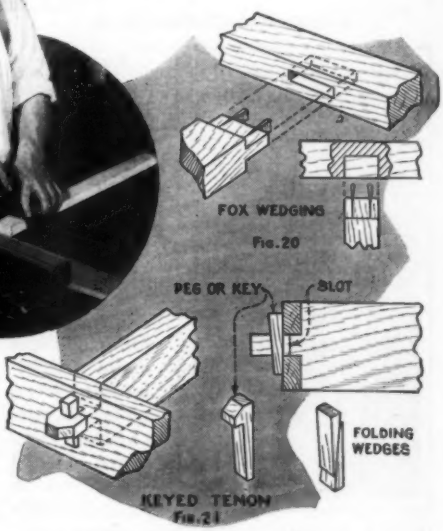
The stub tenon, of course, is not necessarily of the barefaced type; as shown in Fig. 16, it may have two shoulders, bringing the tenon to the center of the stock, or shoulders may be cut on the edges also, thus reducing the size of the tenon. The advantage of the stub tenon is that, as it does not go through the leg, the outer surface of the latter is not marred by showing the end grain of a tenon.

The haunched tenon, Fig. 17, is very often used at the end of a door frame.



When making such a frame, the width of the tenon is reduced, cutting down from the top of the rail, so that there will be sufficient wood above the mortise in the stile to resist the pressure of the tenon when the joint is put together. If a plain tenon were used, however, the faces of the pieces would have a tendency to lip, or become uneven, as indicated in the left-hand sketch, Fig. 17. It is to prevent this lipping that the haunch is employed. The cavity into which the haunch fits is called the haunching, and, in the case of paneled doors or cabinet sides, the haunching is formed by the grooves plowed for the panels. The haunched tenon shown in the lower sketch is sometimes called a secret haunch, because, as the haunch is beveled off and fits into a corresponding cavity in the stile, no sign of the haunching is visible on the outside. Fig. 18 gives the names of tenon parts. The right-hand drawing shows a good practice for the amateur when making up mortise-and-tenon joints at the end of a frame. The stile is left a couple of inches longer than the finished length, to avoid any danger of breaking out the wood beyond the mortise, either when cutting the latter or when assembling the joint. When the joint is made up, and the glue has set, the horn is cut off and dressed flush.

There are two methods of wedging through tenons, and both are shown in Fig. 19. In the first, two saw kerfs are cut down the tenon, and the mortise is beveled toward the outer edge, to allow for the spreading of the tenon when the wedges are driven in. The wedges should be thin, and the beveling just sufficient to accommodate the wood. They are cut longer than necessary, and, when the glue is set, cut off and dressed down. In the second method, no saw kerfs are used, and the wedges are driven in on the outer edges of the tenon, the mortise being beveled, as before, toward the outside. The method of cutting the wedges, to avoid waste of stock, is also shown in Fig. 19, the angle of the wedges being greatly exaggerated.



The method of wedging a stub tenon is shown in Fig. 20, and is called fox-wedging. The joint must be carefully made and fitted before the wedges are set in position for making up the joint, and the worker must be sure that the wedges are of the proper thickness and not too long, for, if the tenon is driven home and everything is not just right, he may find, when too late, that the joint is a very "foxy" one indeed, and that it is impossible to pull it

apart in order to fix things properly. In all these joints, the mortises and tenons, as well as the wedges, are coated with glue, although, for outside work such as doors, many old-time carpenters coat the joint surfaces liberally with white-lead paint instead of glue, dipping the wedges in the paint also.

The mortise and tenon shown in Fig. 21 is generally employed for "knock-down" construction, although, with a headed key, it was a favorite joint for some types of Mission furniture. It will be observed, from the section, that the slot cut for the key, or peg, should be long enough to prevent the key from striking the bottom of the slot before the joint is drawn up tight; in other words, 3/16 in., or so, of the slot should still be left inside the mortise when the key is driven down tight. Three forms of key are shown, the plain one and the folding wedges being used for such articles as knock-down garden or similar furniture, and for rough construction, and the one with the head for Mission furniture, etc.

Improvised Clothes Press

In a bedroom which had no clothes closet, a resourceful housewife provided a satisfactory clothes press on the back of the door as shown in the photo. It was made of lightweight green canvas, although cretonne would serve just as well. The material is attached to the door in practically the same way as a door curtain, excepting that it is not drawn taut but left loose to provide sufficient space for the clothes. In this case, the material was doubled and the clothes put between, but one thickness is all that is required. The clothes are supported on a screwhook driven into the door.—W. W. Snypp, Lakewood, Ohio.

Cleaning Burnt Pans

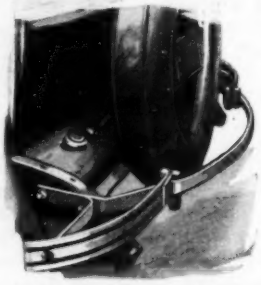
Boiling soda water in burnt pans is often advocated but, although this method seems successful in removing the burnt food, it makes the pans apt to burn again. A better method is to fill the pans with a saturated solution of salt and water, letting the solution stand overnight. Then put the pan on the flame and bring the water to a boil, which will cause the burnt particles to loosen so that they can be removed without any trouble.

Renewing Silk

To restore the luster of silk, pare and grate a few potatoes in cold water, two medium-sized tubers to each quart. Mix well and then let the solution stand for a couple of hours. The clear solution is poured off into another container, and the silk is rinsed in it. Hang the silk up to dry without wringing and, while it is still slightly damp, iron it on the right side first. This will produce a gloss.

Simple Trailer Attachment

To eliminate the jar and noise caused by a trailer, an auto owner devised the simple arrangement shown in the photo. It consists of an old Ford spring leaf attached to the rear bumpers as indicated, a bolt being passed through the eyes on both spring leaf and bumper. The resiliency of the spring leaf and bumper supports absorbs the sudden jars caused by starting and stopping when the trailer is attached. A hole is drilled in the center of the spring leaf and an eyebolt is inserted when the trailer is attached.—Howard Fowler, Rogers, Ark.



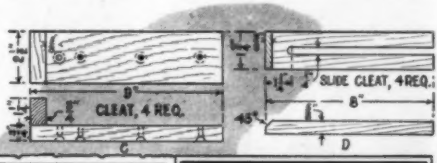
SHOP NOTES

Two Useful Tools for Home Mechanics

By EDWIN M. LOVE

THIS machine age has freed the crafts from slavish drudgery, and has multiplied the output manyfold. Likewise, it has specialized the mechanic, removing the need of versatile skill. In the woodworking line, lumber is delivered to the carpenter's hand ready squared, dressed and sanded. Flooring boards are tongued and grooved; rounds and moldings are "stuck" by machine, and the cabinetmaker can purchase made-up inlay bands and carvings to be glued to any backing.

But the home mechanic, of necessity, follows the customs of the old-time craftsman. Quantity production and duplication are far from his mind, for every piece he builds differs from the others. True, he can, and does use mill-sized lumber,



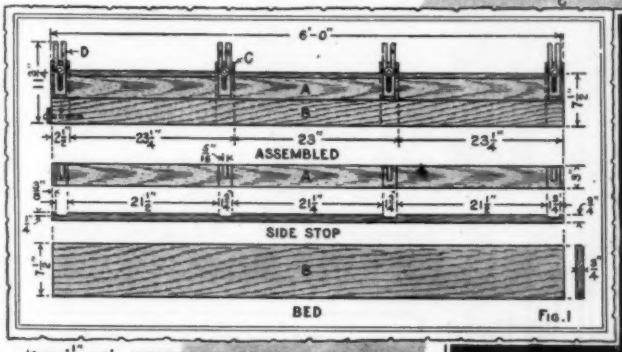


Fig. 1

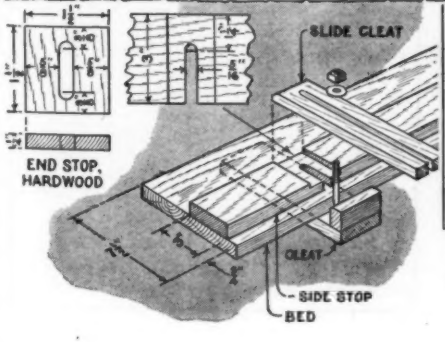


Fig. 1, Details of the Construction of the Molding Board; Fig. 2, Working a Rabbet on the Edge of a Piece Held in the Molding Board

and many a handy man lightens his tasks with woodworking machines, but, for the most part, he must make his dadoes and rabbets by hand, as well as small box parts, specially designed moldings, and the like. This means that he really should have a wider assortment of hand tools than is needed by his journeyman brother —and he generally has a limited number. But, with the expenditure of a little money and a few hours of time, he can build excellent jigs to facilitate his work.

Two such jigs are illustrated herewith: a molding board, and an adjustable shooting board. While definite dimensions are given, they may be varied to suit the needs

Fig. 3, the Completed Molding Board; Figs. 4 and 5, Details of the Shooting Board

of the individual. Most home mechanics will find enough scrap material for both tools. Hardwood is preferable, but for large parts pine may be used with the assurance that it will be serviceable for a long while.

Fig. 1 details the molding board. It may be reduced in length by 3 ft., if desired. Select for the bed a flat, straight 1 by 8-in. board, preferably vertical-grained, and joint one edge straight and square. Make four cleats, ¾ by 2½ in. by 9 in., drilling them, and countersinking, on the underside, for three flat-head wood screws, with which to attach them beneath the bed. Space them so that one end of each cleat will be flush with the jointed edge of the bed board. To the other end, on top, glue and nail a ¾ by 1¼ by 2½ in. block. Put one cleat at each end of the board, and the other two dividing the board evenly. Drill lead holes for the screws, so that there will be no possibility of splitting the bed.

A piece, ¾ by 3 in. by 6 ft., is next straightened, to serve as the adjustable side stop. Four dadoes, centering on the bed cleats when the stop is rested on the bed with ends flush, are cut full width of the stop, ¼ in. deep and 1¾ in. wide. Mark the dado sides with a sharp knife, and cut with the saw kerf in the waste wood. Make four hardwood cleats, ⅝ by 1¾ in. by 8 in. Bore a ¼-in. hole 1¼ in. from the end of each, centering on the

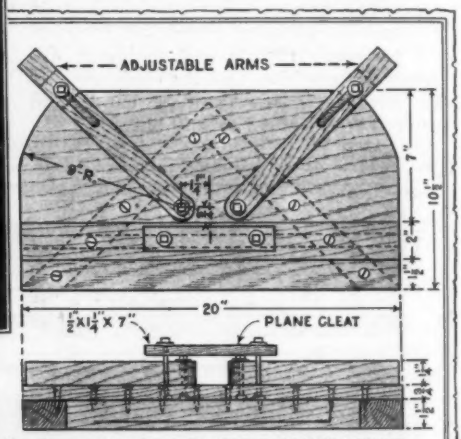
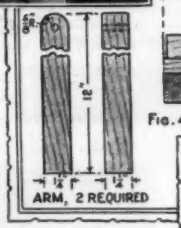


Fig. 4 PLAN AND ELEVATION OF SHOOTING BOARD



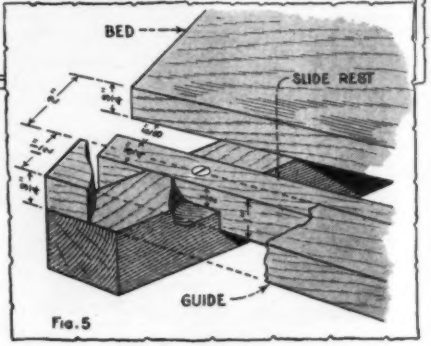


Fig. 5

Upper Left, Top View, and Below, Bottom View of the Shooting Board; Note the Plane Clamped to the Side

width; gauge lines to it from the far end, and rip out the slot indicated. Glue and nail these cleats into the dadoes of the stop, with the solid ends to the front. Saw the slots to the bottom, through the stop, when the glue is set. Lay the stop on the bed, ends flush, and bore ¼-in. bolt holes through the bed cleats, guiding the bit through the stop slots and against the back edge of the bed, and counterbore for the bolt heads. Pass ¼ by 3-in. bolts through the cleats and stop cleats, and chamfer the front ends of the cleats ⅜ by ⅜ in.

The end stop is a ¼ by 1½-in. hardwood block slotted to allow a long ¼-in. round-head wood screw to pass through with a vertical adjustment for projection above the bed. For a right-handed workman, screw this stop to the left end of the bed, flush with the front edge; for a left-handed mechanic, put it on the right end. Oil the molding board when completed.

To use this device, rest it on a bench, with the end against the bench stop. Adjust the margin between the front edge of the bed and the side stop to a little less than the width of the molding to be made or the strip to be rabbeted, and screw the bolt nuts down firmly. Adjust the end stop so high that it will clear the plane and yet hold the work.

The shooting board is dimensioned in Figs. 4 and 5. It consists of a pair of adjustable angular arms, clamped to a bed, and a slide or carriage to which a plane is rigidly clamped. The ordinary shooting boards usually have the arms fixed at an angle of 45° with the front of the board, and the latter alone acting as a plane guide. The advantages of adjustable arms are obvious, while the mounting of the plane on a slide prevents the blade from cutting into the guide and destroying its usefulness.

For the bed board, square up a rectan-

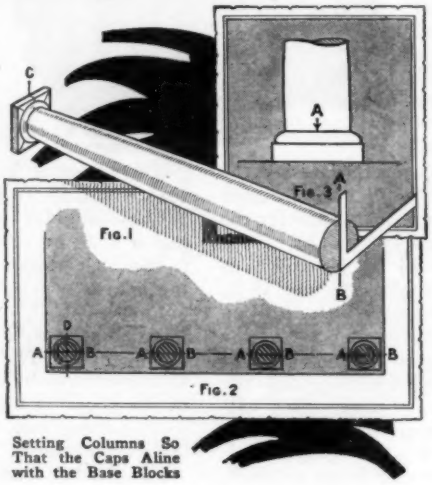
gle of wood, ¾ by 7 by 20 in. Five-ply stock is excellent for this, as it will neither shrink nor warp. Square a center line across the width. Locate points, 1¼ in. to the right and left of the center, ¾ in. from the front edge, and with these as centers, using a radius of 9 in., strike arcs through the opposite corners. Saw to these lines, and smooth the curves. To the underside screw two pieces of 1½ by 1½-in. net stock, forming a right angle centered on the bed, with the point ½ in. from the back edge. The ends should project 3½ in. beyond the front edge. The screws, of course, must be countersunk below the surface, so that they will not prevent the moldings to be "shot" from lying flat on the board.

Make a ¾ by 2 by 20-in. strip for a slide, being especially careful to preserve exactness in the width. The guide is 1½ in. wide, and the same length as the slide. Lay the slide in place on the cleats, clamp the guide against it and screw the guide to the cleats. Remove the slide, wax the edges and replace. If it does not slide easily, take a shaving off the width, but make it fit as closely as possible.

As a bottom for the slide ways, sink a ¾ by 1-in. strip into the cleats until it is flush with the top. Lay it in the center of the slide opening and mark its position on the tops of the cleats. Likewise scribe the cleats on the underside of the strip. Notch it ½ in. deep, and the cleats ½ in. deep. Secure with countersunk screws, but do not glue. It can be replaced easily when worn.

The arms are 1¼ by 1¼ by 12 in., rounded at one end and pierced with a ¼-in. hole centering on the curve. A slot, centering on the width, 2¾ in. long, and 2½ in. from the square end, is made by boring with a ¼-in. bit and trimming the sides with a chisel. Attach these arms to the bed with bolts through the two front holes, and pass 2½-in. bolts through the slots. Washers, either wood or iron, under the heads allow the free ends of the arms to be clamped solidly in any position. Two bolts through a ½ by 1¼-in. hardwood strip straddle the plane to be used on the slide. A block plane is best, and the heads of the bolts must be sunk into the lower surface of the slide, so as not to interfere with its motion.

To use the shooting board, remove the slide and lay it on edge on a flat surface. Stand the plane beside it and clamp with the bolts. Set the arms for the desired angle, replace the plane-and-slide assembly and hold the cut molding against an arm. To insure that the planing will be done the full width of the plane, the molding must be rested on a strip of ¼-in. stuff, to bring its entire width to the blade. The plane iron should be keen and set very fine. This board can also be used for planing the ends of boards square.



Setting Columns So That the Caps Aline with the Base Blocks

Method of Alining Caps and Base Blocks in Setting Porch Columns

Usually porch columns are set in place before any of the framework above is put together, which is considered the most economical method. However, this makes it more or less difficult to get the caps in alinement with the sides of the base block, unless care is taken and accurate measurements are made. Fig. 1 of the drawing shows a column cut to the right length with the cap nailed on. It is laid on a level surface and a perpendicular line is drawn through the center of the base with the aid of a square, as indicated. A witness mark is then made at each end of this line as shown at A in the upper detail. The base blocks are set in line, on a level, and a chalk mark is

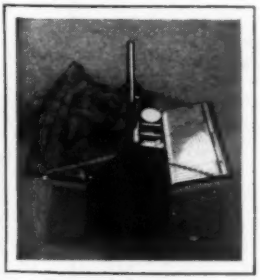
drawn through the center of the base blocks as indicated by the dotted line in the lower detail. Set the columns so that the witness marks are directly over the chalk line. If the work is done carefully, the sides of the caps will be in alinement with the base blocks.

Repair for Windshield-Wiper Arm

The following temporary repair has been found practical on an auto windshield wiper from which the rubber had come off: The wiper arm is removed, and cotton cord is wrapped around it and tied securely at both ends. If the wiper is automatic, it may be necessary to spring the arm out slightly to compensate for the added thickness of the cord. If a hand wiper is used, a light coat of glycerin on the cord will make it work better, preventing the rain from blurring the vision.—L. C. Ferguson, Manteca, Calif.

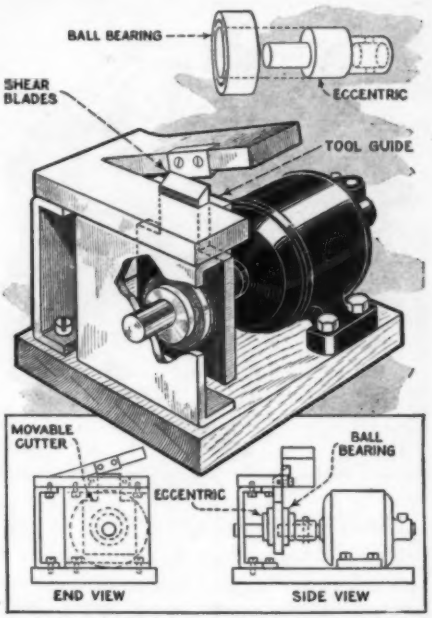
Increasing Utility of Small Tool Box

Electricians, plumbers and other workmen who use small tool boxes of the kind that have lids hinged to the sides, can greatly increase their usefulness by attaching two lengths of chain to the edges of the lids so that the latter can be held in a horizontal position when opened, as shown. In this way small shelves or counters are provided for holding tools and other material. If desired, a shallow tray can be attached to the inside of one or both covers to hold small parts.



SHOP NOTES IN BOOK FORM

For the convenience of readers who desire a permanent collection of these notes indexed for quick reference, we publish in book form all the articles that have appeared in these pages during the year. Send 50 cents to our Book Department for latest issue; information regarding earlier issues available gladly sent upon request.



Small Electrically Operated Bench Shear for Cutting Light Sheet Metal

Small Motor-Driven Shuttle Shear

One workshop uses a novel motor-driven shuttle shear for cutting light sheet metal. Its usefulness will appeal to most small shops. It consists of a heavy steel frame, cut and bent as indicated in the drawing. The frame is mounted on a wooden base, to which a motor is also attached to operate a small cutting blade actuated by an eccentric. The bent section of the frame holds the upper cutter in a position where the lower cutter will move past it with a shearing action. The angle of the former causes shearing instead of a punching, which would be the case if it were parallel to the lower cutter. An extension to the motor shaft runs in a bearing drilled in the frame. The moving blade operates like a shuttle, passing through a free guide in the horizontal section. A hole is drilled in the lower end of the moving cutter to accommodate a ball-bearing race as indicated, which in turn fits on the eccentric of the extension shaft. An eccentricity of 1/16 in. has been found sufficient. A short stroke is delivered but there is powerful cutting action.

Warped Roofing Boards Can Readily Be Straightened by Means of This Device

Device for Straightening Roof Boards

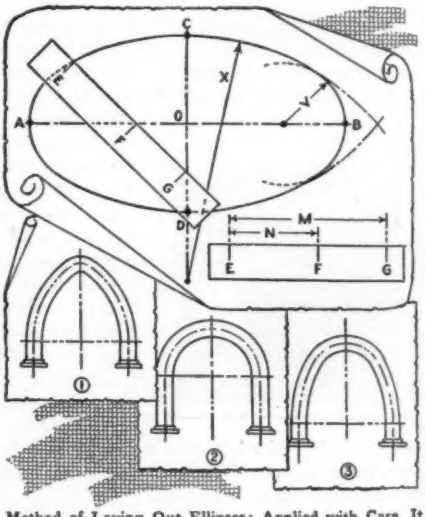
While working on a roof, I made a simple device for closing the cracks between warped roof boards before they were nailed to the rafters. The device consists of a length of a 2 by 4-in. wood, with a block nailed at one end and a lever pivoted to the other, as shown in the illustration. Another small block pivoted on the lever is pressed against the warped board, the long end of the lever being used as a handle. It is not necessary to use the lower block at the end as the 2 by 4-in. board can be nailed to the roof, if desired. This procedure is necessary when the width of the roof boards exceeds the distance from the lower block to the lever. To make the device more convenient, a series of holes may be drilled through the 2 by 4-in. board and a similar hole through the lever so that the two can be held together by means of a carriage bolt.—Kenneth R. Deardorf, Bemidji, Minn.

Use of Bakelite in Photography

Glossing amateur photographic prints, by squeegeeing them to ferrotype plates or glass, is rendered difficult to the beginner because the gelatin must be hardened or the glossy surface covered with some preparation before the prints are applied. This difficulty completely disappears if bakelite is used to hold the pictures while drying. Wet prints can be applied to the smooth surface of the bakelite without any previous hardening or other preparation to avoid sticking. Although bakelite does not possess the intense gloss of glass or ferrotype plates, it has a distinct sheen which will impart a very attractive gloss to the dry print, and the material will last almost indefinitely.

How to Lay Out an Ellipse

Usually the drawing of ellipses is considered a somewhat difficult task, with the result that the draftsman spends either too little or too much time on it. The method described in this article has been used by the writer for many years with excellent results, particularly in designing power-plant piping, where an accurate projection is often needed to check clearances. The basis of the method is an old theorem in geometry. First draw lines representing the major axis AB and the minor axis CD. Then lay off on a small piece of paper the distances M and N, starting both from point E. M must be equal to one-half of the major axis and N equal to one-half of the minor axis. Point F is placed on the line AB, so that E coincides with A and G with O. By turning the strip clockwise with F sliding toward



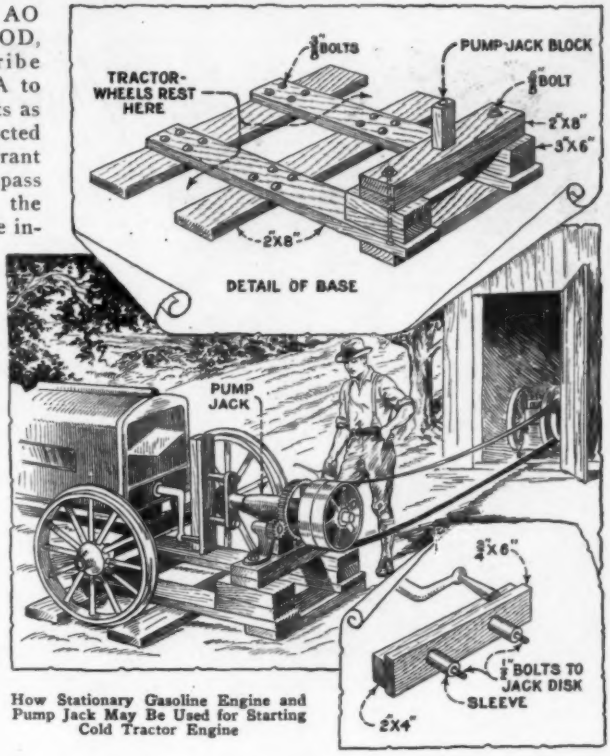
Method of Laying Out Ellipses; Applied with Care, It Produces an Accurate Curve

the right, on the line AO and G downward on line OD, the point E will describe an elliptical curve from A to C. Make a number of dots as you proceed, to be connected later, and form one quadrant of the ellipse. If a compass is used for the purpose, the curve will in most cases be inaccurate. Fig. 1 shows an ellipse which is too pointed; Fig. 2 one which has a semicircular end, and Fig. 4 an ellipse made with the use of a French curve, the joining of the curves showing plainly.—W. E. Patrick, Jr., Salt Lake City, Utah.

Miniature Dikes Keep Concrete Moist

In order to keep new concrete paving moist for several days after it is laid, a western contractor uses the novel method indicated in the photo. When the leveled concrete is still quite "green," it is covered with dirt to a depth of several inches. Part of the dirt is hoed into small dikes, inclosing sections about 4 by 5 ft. square, while leaving a few inches of dirt covering the concrete. The squares are then filled with water nearly to the top. The water prevents the concrete from drying out too rapidly in hot weather. Of course, the water evaporates, but it is easy to replace it when needful.

Concrete Pavement Kept from Drying Too Quickly by Small Water-Retaining Dikes



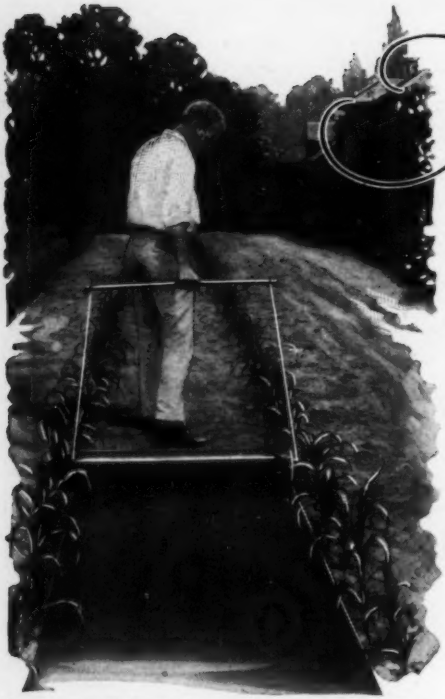
How Stationary Gasoline Engine and Pump Jack May Be Used for Starting Cold Tractor Engine

Stationary Engine Starts Tractor

To start his tractor on cold mornings when the crank can hardly be turned over, one farmer uses an old pump jack and a small stationary gasoline engine, and has found this method highly satisfactory. A suitable frame or cradle is made to hold the pump jack. Two cross planks of the frame are arranged so that they can be slipped under the front wheels of the tractor, in order that the wheels may hold the frame securely during the cranking. A wooden arm, made of 2 by 4-in. and ¾ by 6-in. stuff, is made, as indicated, to take the crank handle of the tractor. Then the engine is belted to the jack and no difficulty will be met in starting it.—H. H. Parker, Los Gatos, Calif.

¶Sections of old leather belts, placed on the floor of the garage, will protect the tires from changes in temperature due to frost on the concrete, and also from oil.

The Latest



Laying the Paper Mulch Is an Easy Task with a Roller Made of a Couple of Broomsticks

NOW YOU can garden without infringing upon your limited time for golf, gunning, fishing, saddling, motoring or other outdoor pastimes which tempt you from the sunrise of spring until the advent of late autumn.

The suburbanite, townsman, villager or farmer all have available a new system of green-vegetable production which controls weeds, minimizes cultivation, guarantees good germination even during unfavorable seasons, doubles or even quadruples yield, engenders earlier maturity and affords the amateur or professional gardener plenty of time for other diversions.

When Charles F. Eckart, manager of a large sugar plantation in Hawaii, hit upon the scheme of using asphalt paper as a mulch to prevent weeds and conserve moisture, he originated a practice which potentially will prove a boon to gardeners around the world. Paper farming has rescued pineapple growing from the doldrums of despair and has introduced that branch of agriculture to permanent prosperity. Nine-tenths of the successful pineapple plantations now use heavy asphalt paper as a crop mulch. One application in the tropics lasts for three to five years and eliminates all cultivation of the fields during that period. Hawaiian growers alone expended more than $500,000 for this protective paper with which they covered their pineapple fields last year. A very good investment, incidentally, as the average yield was increased from 30 to 50 per cent in this way.

Your home garden makes grateful responses to similar treatment in increased production and improved quality of produce. The efficacy of the system is greatest during the most unfavorable seasons, but it is a profitable practice every year, irrespective of weather conditions. Paper farming concentrates your work of gardening into a couple of days in the spring, when you apply the paper mulch and plant the seed. About all you have to do, subsequently, is to watch your garden's miraculous growth and harvest it.

In the Patented Eckart System, the Seeds Are Planted through Holes Cut in the Paper Mulch

An Amateur's Garden Protected by Asphalt Paper; the Paper Is Held Down Simply by Shoveling Dirt over the Mulch after It Has Been Laid

There are two systems of applying the impervious paper. The easier method, and the one most suitable for the back-yard gardener, is to paper the rows after the seed has been planted, leaving a 2 or 3-in. space of uncovered soil in each row through which the seeds may sprout and greet the stimulation of sunshine. The other system is one originated and patented by Mr. Eckart and consists in cutting holes through the paper and planting the seed or setting plants from the nursery or greenhouse in the soil through such apertures. This latter method is much more laborious, although it affords the most complete protection for the garden.

Varieties of wood-pulp paper treated with asphalt whose wearing qualities are remarkable are now available in two popular widths, 18 and 36 in. This paper comes in rolls of 150 yd. each and sells for from $4 to $6 a roll. The initial cost is high, but considering the durability of the paper in warm climates, it is an excellent investment.

The writer, and several other amateur gardeners who have experimented with the paper mulch, have ascertained that ordinary black asphalt building paper, costing $1.50 for a roll which will cover 500 sq. ft., is well adapted to their requirements. Under the most favorable conditions, one application of this paper will last for two years and will eliminate the plowing and cultural practices necessary in preparing the seedbed the second year. Strips of the paper which have become seriously weathered or are damaged with holes and cracks will, of course, have to be replaced as needed.

You can make a roller from a couple of discarded broom handles which will simplify the task of papering your garden. Each handle should be 37 in. long with a screweye sunk in each end. Two lengths of No. 10 galvanized wire, each 4 ft. long, are hooked so that they will snap readily into the screweyes. One broomstick is inserted through the center of the roll of 36-in. paper and is then fastened to its

Corn without Paper, Six Weeks after Planting, 11 Inches High

mate, which serves as the handle of the homespun rolling device for applying the paper. The same outfit can be used for 18-in. paper rolls by boring two holes, 19 in. apart, at the central portion of the roller and inserting wooden or metal pins to hold the roll in proper position as it is applied to the garden.

If you experience difficulty in obtaining 18-in. rolls of cheap paper, the best method of cutting the 36-in. roll is to unroll it on the ground and cut it by hand with a sharp knife. It is not necessary to mark the paper. The average person with a good eye can split the roll evenly enough for gardening purposes. Of course the seed should be planted in rows just a trifle farther apart than the width of the paper.

The paper, after application, is held in place by the use of large staples made of No. 10 wire or by wooden strips, rocks or loose soil. The staples should be made a little wider than the roll, with 10-in. points, so that they can be anchored securely in the ground with their heads holding the mulch material in position.

The writer has used loose dirt successfully as paper weights, placing it along each edge of the paper or shoveling soil crosswise of the mulch at 3-ft. intervals along the row. It is advisable to stagger smaller vegetables, such as beets, carrots, radishes and onions, among the larger, such as corn, peas and pole beans, in order that the latter may serve as windbreaks and aid in protecting the paper from the violence of summer storms.

The paper mulch smothers out weeds, conserves soil moisture and provides an extraordinarily effective irrigation. Many summer rains are so light that the precipitation does not accomplish much good when distributed uniformly over the garden rows. The paper mulch concentrates this rainfall directly around the plant roots where it accomplishes maximum benefit. If you sprinkle your garden during drouthy weather, the paper mulch reduces the amount of water necessary for a good drenching by draining all that falls in the inter-row spaces directly into the rows of growing vegetables. Where an abundance of moisture is husbanded in the soil during the growing season, larger supplies of plant food are made available for crop use. Plenty of moisture and equable soil temperatures increase the activity of the soil bacteria which serve as "chefs" for the maturing vegetables by providing them with plenty to eat. The paper mulch also acts as an ideal insulator

How the Young Corn Sprouts through the Holes in the Paper Mulch

for the ordinary garden, as it keeps in the heat and shuts out the cold. The soil temperature is increased from 5 to 10° where the paper mulch is used. Seeds thus germinate more uniformly and rapidly than usual, while the tender seedlings grow under adverse weather conditions when neighboring gardens, not papered, are practically dormant, with seed rotting in the ground. Crops mature from two to four weeks earlier as a result of the protective blanket of paper. This means that you are able to enjoy green peas, spinach, beets and carrots fresh from your garden while your neighbor who scoffs at paper farming is still dreaming about the future when his garden will come into bearing. In certain localities, the use of the paper mulch makes it possible to raise two crops of the same vegetable in one season because it measurably reduces the maturity period. Sweet potatoes under paper can now be raised as far north as Vermont—a hitherto undreamed of gardening feat.

Above, Laying the Mulch; Below, Six-Week Corn Protected by Paper, 22 Inches High

"Plant one seed for the sparrow, one for the crow, one for the cutworm and two to grow," is the venerable slogan of the corn farmer. The papered garden eliminates seed losses due to crows, pigeons and other winged plunderers. The paper acts as an effective scarecrow. The birds are suspicious and evidently believe that the black paper is some sort of a snare. They fly shy of the paper-mulch garden, much to the satisfaction of the gardener.

Inter-row crops, such as spinach, beets, carrots, lettuce and radishes, can be raised successfully between rows of corn under the paper-mulch system. Where land is extremely high-priced or where the gardening tract is small, this practice is advantageous. The inter-row crop can be planted in midsummer, if desired, as the corn plants at that time will shade the tender seedlings from the hot sun and will facilitate their speedy development. Strips, 1 to 2 in. wide, can be cut the length of the paper so that the inter-row crop can be planted.

The paper mulch holds moisture in the surface 4 in. of soil even two weeks after the last rainfall. Tests made at the Arlington farm, Va., the national proving ground of scientific agriculture operated by the government, show that the moisture content of the surface soil two days after a rain is one-sixth greater under the paper than at an unprotected point, 18 in. from the border of the paper mulch. Two weeks after a rain, the moisture of the soil under the paper was one-fourth greater than at a similar depth in the same garden where the paper mulch was not used. Cleaner vegetables of better market quality result where the paper-mulch method is practiced. This is particularly true of vegetables like tomatoes,

which are apt to come in contact with the soil unless well trellised.

During wet weather, it is practically impossible to enter the ordinary garden in order to pick its "fruits" for the dinner table. The paper mulch favors harvest at any time, even during a rainstorm, as the housewife can walk carefully on the wet paper without tearing it and without risk of getting mired. You can walk at will over the papered garden during dry weather without packing the soil at the eventual expense of curtailed yield.

The paper mulch stimulates plant growth in some baffling manner which at present mystifies science. The department of agriculture has begun comprehensive experiments to ascertain how this gardening miracle is wrought. Scientists were at first skeptical about the long-term benefits of paper farming. They feared that the extended use of the paper "topcoat" would result in soil oxygen starvation, decreased yields and inferior crop quality. Practical tests, however, have demonstrated this theory as incorrect.

The writer has found that the paper mulch is admirably adapted for use in the home vineyard, in the rose garden and for the protection of seedling trees which are being grown in nursery rows until large enough to be transplanted as ornamental shade trees here and there about the lawn. It is a little more trouble to cut out and fit the paper in the vineyard, but the work pays big dividends in an increased harvest. Rose bushes are protected against drouth where the paper mulch is employed, and a dozen or more hand hoeings each year are eliminated. Regular applications of fertilizer can be made to the seedling trees protected by paper mulch by lifting the paper temporarily and replacing it after the job is finished. This serves as a satisfactory substitute for the forest blanket of leaves, pine needles and other decaying vegetation which in nature facilitates tree growth. The paper mulch simplifies strawberry, cantaloupe and watermelon production and insures fruits free from soil contamination.

Auto-Tire Pump, Hose and Nozzle Make a Good Chip and Dirt Remover

Gluing Ivories on Piano Keys

A simple method of gluing ivories on piano keys is to get a little oxide of zinc (white) and mix it with ordinary glue. File or sand both the surface of the key and that of the ivory. Apply the glue to the key, and let it stand for 5 or 10 minutes before placing the ivory on it. Press the ivory in place and then wrap ordinary twine around both key and ivory. In three or four hours the glue will have set sufficiently to permit filing or sanding the dry glue off the sides. Do not apply water to it unless waterproof glue has been used. I have used this method successfully for many years in repairing pianos.—W. F. Caldwell, Portland, Oreg.

Handy Chip and Dirt Blower for the Floor Repairman

In patching an old floor, some trouble was experienced in fitting the butts and edges together properly, owing to dirt getting into the grooves and under the tongues. Sweeping did not remove it, so the simple blower shown in the drawing was improvised. It consists of an old auto-tire pump, a length of rubber tubing and a nozzle made by flattening the end of a short piece of copper tubing of the kind used in gasoline lines of autos. A hose clamp or a length of wire holds the nozzle securely. A few strokes blows all the dust and dirt out of the grooves and corners, so that the floor boards can be fitted accurately.

Cheap Stump Puller

In the Pacific northwest, where there are far more fields of stumps than there are fields under cultivation, you see all sorts of devices for pulling stumps. One of the cheapest and most successful I have observed was constructed as follows: A discarded Ford auto, with the wheels removed and the chassis mounted on a sled, was used to provide power. To each rear axle was fitted a pinion gear. The pinions drove a single shaft, with a gear on each end, and another pinion gear, which in turn drove a small cable drum. The rear axles, the bearings for the shaft and the drum were set on a piece of mild-steel bar to keep the gears in mesh. Both bearings and bar were securely bolted to the sled. The gear reduction obtained was 3½ to 1 for the car rear end, 2 to 1 for the rear axles to the drum pinion shaft, and 3 to 1 for the final drive, making a total of 21 turns of the motor to one turn of the drum. In this way plenty of power was obtained in high gear and almost unlimited power in low.—K. E. Corliss, Langley, Washington.

Hammer Serves as Rule

We often neglect taking a rule along for small jobs, but before we get very far, it may be necessary to use one, or else resort to some "rule-o'-thumb" method, which is rather inaccurate. It is a good idea to make your hammer serve as a rule in such cases, and that can be done if you graduate it. To do this, take two small brass-headed tacks and drive them into the hammer handle, 6 and 9 in. from the end, as indicated.

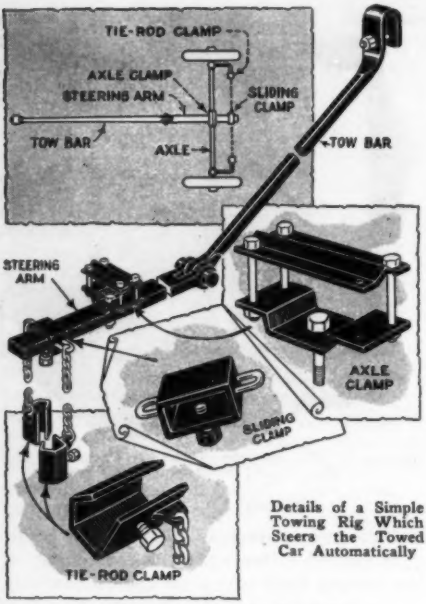
Homemade Oat Sprouter Which Is Cheap and Has Been Found Entirely Satisfactory

Efficient Oat Sprouter

The oat sprouter shown in the photo was made 5 ft. high and 2½ ft. square. A full-length door was provided on one side, and six strips of wood were arranged along two sides so that trays in which the oats were sprouted could be easily slid in and out. The top of the sprouter was covered with sacking material for ventilation, and the rest was covered with tin on the outside, to prevent the entrance of rodents. The trays were about 3 in. deep, tin or heavy wood being used for the bottom. Each tray was half filled with earth and oats or wheat, and the earth was then saturated with water. A small oil stove or lamp was placed in the bottom and burned just enough to keep the sprouter warm. By using a knife, the oats can be cut out in pieces, the sand and all being placed in the chick pens.—David J. Morris, Weir, Tex.

Melting Rods for Wax Heated with Curling Iron

The task of heating melting rods for flowing wax into wood pattern fillets has usually been more or less troublesome. We have found, however, that an ordinary curling iron is an ideal tool for the purpose. The spring member is removed, and it is an easy matter to attach tips for the various-size fillets.—C. H. Benedict, Greenfield, Mass.



Details of a Simple Towing Rig Which Steers the Towed Car Automatically

Tow Bar Steers Towed Car

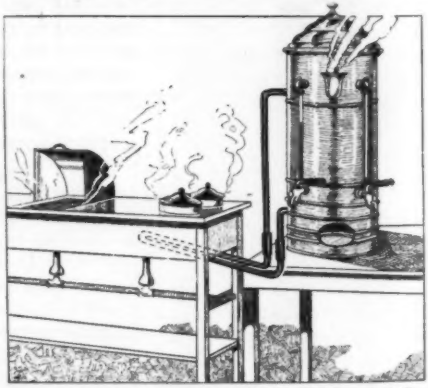
When a garage attendant has to tow a car single-handed, it is almost necessary to raise the front end with a tow-truck crane. In the absence of a crane, a single-handed towing job is almost impossible unless a tow bar of the kind shown in the illustration is used. It consists of two sections, pivoted horizontally to allow for road inequalities. These sections are made from round and flat iron, as indicated, the rod part being the longer of the two and having a U-shaped clamp at one end to permit attachment to the towing truck. An axle clamp, shown in the detail, is bolted to the flat section, and is used for attaching the tow bar to the front axle of the car being towed. It is necessary that the axle clamp be pivoted to the flat section so that the latter can swing to the right and left, this movement being used to steer the towed car. Two lengths of chain are fastened by means of suitable clamps to the tie-rods and to the tow bar, or rather to the steering-arm section of the tow bar, as shown by the dotted lines in the upper detail. The clamp on the steering arm is a sliding arrangement equipped with a setscrew so that it can be securely fastened at any point. The tie-rod clamps also have setscrews to keep them in place securely.—C. B. Evans, Ottawa, Can.

Thread Tool Forms Straightedge

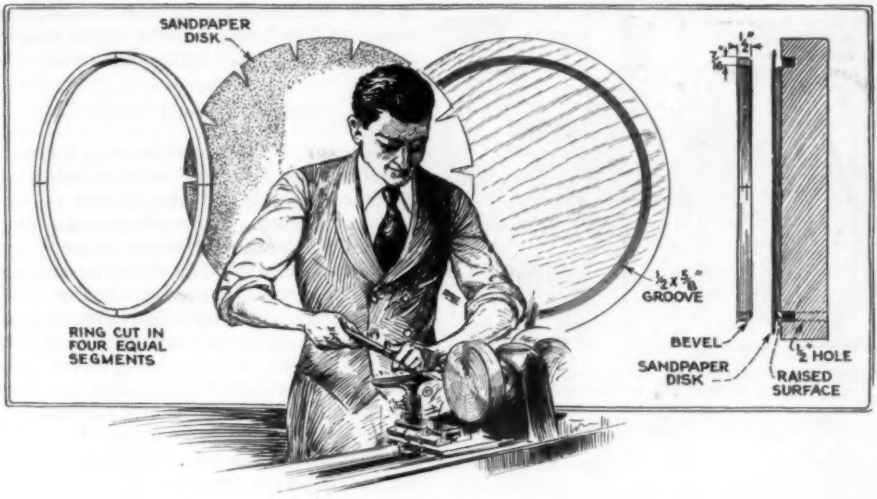
Owners of Pratt and Whitney type of thread-cutting tools are able to use the fine pitch points as a straightedge for tool work. On a 40-pitch thread, for example, the width of the flat at the top and bottom of the thread is only .003125 in., and, as this flat is lapped on the tool, it forms practically a knife-edge, which is quite true and forms a perfect straightedge.—James McIntyre, Hartford, Conn.

Single Burner for Steam Table and Coffee Urn

We had been running a steam table and coffee urn with two separate gasoline burners, and the one under the urn could not be turned down low without going out all the time. I tried electric burners but their use was too expensive, so I devised the method shown in the drawing and found it entirely satisfactory. Only one burner is used for both the steam table and the coffee urn. Lengths of ¾-in. pipe are used to extend from the urn to the burner under the steam table, two rubber-tube connections being provided in the pipes just below the urn so that the pipes can be pushed to one side in case the water boils in the urn.—E. V. Pierce, Morris, Ill.



Reducing the Cost of Heating Steam Table and Coffee Urn by Using One Burner



Sand Disk for Small Lathe

By W. CLYDE LAMMEY

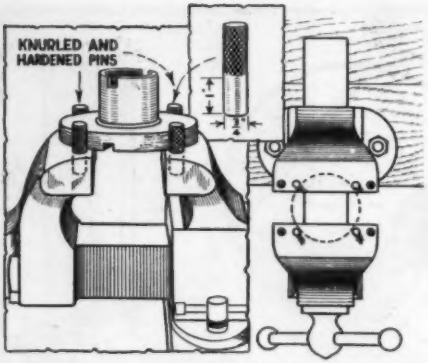
A SAND disk for the workshop lathe is an extremely handy accessory, and where the price of the commercial disk is prohibitive, a very good one may be made to do the same work at a cost next to nothing, save the time spent. In size, the disk must be adapted to the swing of the lathe. For instance, if the lathe has a 9-in. swing, the disk may be 8½ in. diameter. Select a piece of birch or gum stock and saw out a disk to the required diameter, then true and face it off in the lathe. The disk should be made of 1⅛-in. stock. Turn a rabbet on the rim, ⅛ in. deep and 1½ in. wide. Round the shoulder of the rabbet slightly, and, using the shoulder as a guide, sink a groove, ½ in. wide and ⅝ in. deep. Centering in the groove, bore four ½-in. holes, equally spaced, through the disk.

Saw out another disk from ½-in. stock, of the same diameter as the circle formed by the outer edge of the groove in the first. Bevel this disk slightly in the lathe as indicated, making the bevel run from face to back. Strike a line with a sharp-pointed pencil just 7/16 in. from the face edge and, holding the chisel to this line, cut off the ring. Cut the groove larger than the width of the chisel to prevent binding. Then cut the ring into four equal segments.

Using an old pair of shears, cut a disk from an ordinary sheet of sandpaper of the required grade and large enough diameter to extend ⅛ in. beyond the outer edge of the groove all around the sand disk. Cut a number of V-notches about the edge of the paper as shown, and, laying this over the raised portion of the disk, drive the ring segments tightly into the groove, thus binding the paper in place. When it is necessary to change the paper drive out the ring segments with dowels set in the holes on the back of the disk.

It will be seen that only the surface of the paper is presented to the work, as the ring segments are below the edge in the rabbet, and do not interfere with the sanding in any way. Be particular to get the disk centered on the lathe faceplate so that it runs without vibration. For sanding end grain and a variety of small work, a disk is practically indispensable as it cuts very fast and leaves the work smooth.

¶A long nail in the end of a broomstick is convenient for picking up leaves that have blown on a raked lawn; a few notches should be filed in the nail.



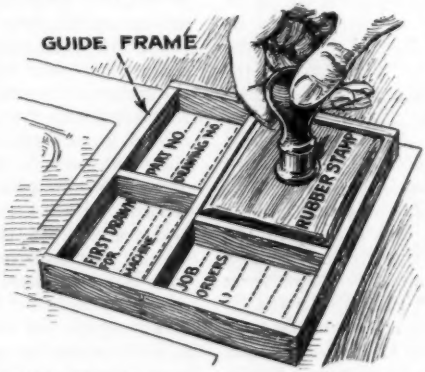
Knurled and Hardened Pins, Set in Holes in Vise Jaws, Hold Disk-Shaped Parts Securely

Pins Hold Circular Parts on Vise

Limitations of the jaw opening and the impracticability of holding disk-shaped parts in the usual bench vise can be overcome by the use of pins or studs set into the upper faces of the jaws. Four holes are drilled into the soft section of the jaws, and steel pins are inserted into the holes. Extra holes may be drilled to hold disks of various sizes, and, if desired, the upper ends of the pins may be knurled and hardened to obtain a firmer grip.

Guide for Stamp on Tracing Cloth

Although the use of rubber stamps for printing titles, lists of material, etc., on tracings has been found a timesaver, it is often difficult to place the imprint squarely on the tracing. To facilitate this, one engineering office uses a simple frame to guide the stamp, which can be knocked together from strips of wood in a few moments. The illustration shows a frame which is used for four stamps. The frame is laid on the tracing, and held securely with one hand, while the proper stamp is put in one of the divisions and the imprint made on the tracing. The result is that all the lettering will be in alinement.



Wooden Frame Serves as Guide for Rubber Stamps to Get Impression Squarely on Tracing

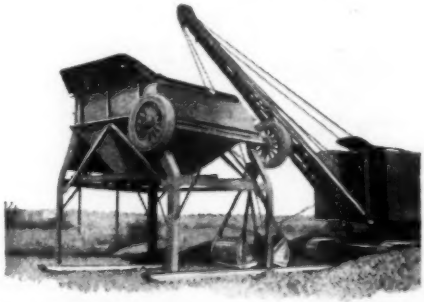
Care of Animal Traps

Success in trapping fur-bearing animals, whether done for profit or as a hobby or pastime, depends on the fitness of the equipment used. No work can be done well unless the tools used are properly adjusted and handled. Traps are your tools in this instance and need good care. Oiling of traps is not especially recommended, but in some cases fish oil is used, or lard may be applied, the trap being heated just enough to melt the lard so that it covers the metal. The pungent odor of most oils is likely to keep the game away. Some old trappers bury their traps in old leaves under still water where the pile will lie undisturbed. When needed, they are taken out, blackened but practically free from rust. These traps are not easily detected by the game. A good method of blackening new traps is to boil them for an hour in water to which ½ bu. of walnut hulls has been added. Then transfer the trap to fresh water, boil for another hour, and hang up to dry near heat without wiping. When cleaning rusty traps, never use kerosene. Rub the traps with fine sandpaper and a file, then boil them in a solution of walnut, maple or oak bark, after which they are hung up near a fire to dry. A light coating of rust is harmless. For snow trapping, it is desirable to make the traps white. This can be done by putting them in a kettle of water and adding ½ pt. of unslaked lime. Bring this to a boil and keep the traps in the boiling water for about ten minutes. They will come out white and absolutely odorless. Hang them up to dry. You can etch your name on the traps if you want to prove ownership in case of theft. Warm a trap and rub candle grease or par-

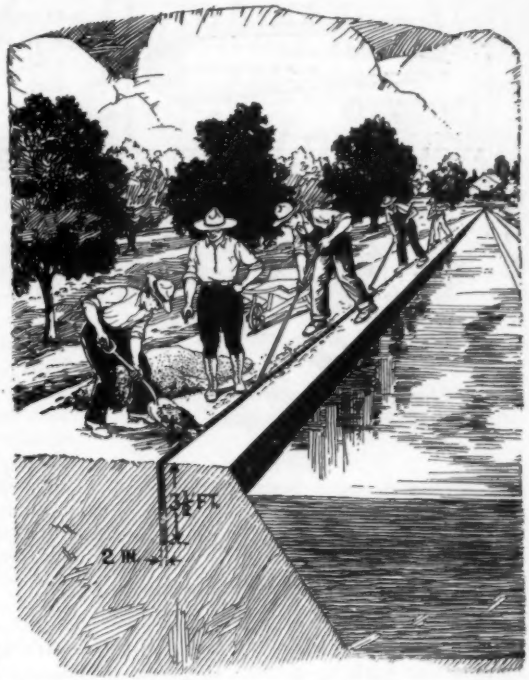
affin over the spot to be marked. Then write your name in the grease with a sharp-pointed steel instrument, clear through to the steel. Pour a few drops of a mixture consisting of muriatic acid, 4 parts, and nitric acid, 1 part, into the scratched marks, taking care not to get any acid on your hands or clothes, as it causes severe burns. In a few minutes, the acid can be washed off and the wax melted. The name will be indelibly etched in the steel. It is also a good idea to carry a camera with you on the trap line. It will give you authentic proof of the animal you caught, its size, markings, etc., and will prove valuable and trustworthy in later arguments with friends. Use a small compact outfit with a fast lens and speedy shutter. A film camera will be the best to carry.

Dirt Hopper Fitted with Wheels

The dirt hopper shown in the photo is filled with a steam shovel in the usual way and then a truck goes under it and takes the load. Instead of hauling the hopper from one job to another on a truck, a contractor provided it with wheels as shown. This enabled him to fasten it to the back end of a truck in the same way as a trailer and tow it, which required much less time than loading it on a truck. The hopper is tipped over onto the wheels, and the legs on the wheel side raised to the back of the truck. —Carlton Groat, Portland, Oreg.



Dirt Holder Provided with Wheels to Facilitate Its Transportation



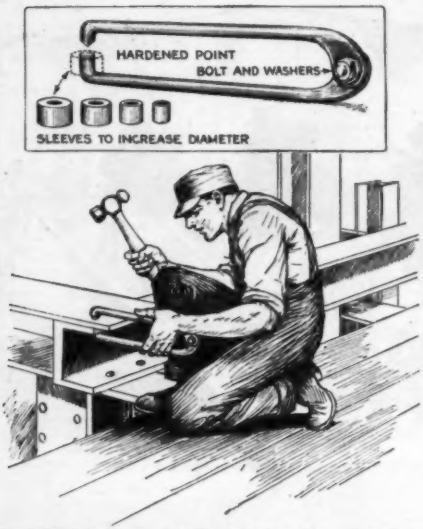
Narrow Concrete Diaphragm, About 3 Ft. Deep, Prevents Breaks Caused by Gophers in Irrigation-Canal Banks

Concrete Diaphragm Protects Canal Bank from Gophers

Concrete poured in a trench dug in irrigation-canal banks near the water's edge, as shown in the illustration, affords protection against breaks caused by gophers and other burrowing animals during the summer and fall months. The trench should be about 2 in. wide and about 3 ft. deep, and can be dug by means of specially made, hook-shaped hoes with long handles. Six workmen can dig a 100-ft. trench and fill it in an eight-hour day.

Bees Earn Income by Pollenizing Fruit Blossoms

One bee keeper derives additional profit from his bees by renting them to neighboring farmers to pollenize fruit blossoms. The bees are rented for about ten days, and when the blossoms have fallen, are returned to their owner who gets $3 per hive for their service.



Tool Which Facilitates Transferring Hole Locations from Channels and I-Beams

Tool for Transferring Hole Locations

In structural iron work, there are many occasions to transfer holes from I-beams, channels or built-up girders, to plates or adjacent material so that it may be drilled with coincident holes. The restricted space on the I-beams, etc., which does not allow for the use of a drill to locate the holes by drilling through, is the obvious reason for transferring them to the top of the plate. An excellent tool for this use was developed by a worker and is shown in the illustration. It is made up as a caliper, consisting of two hinged legs, which work on an accurately fitted pivot. One leg terminates in a hardened-steel point that is used as a center punch. The other leg is made up as a plug to engage the hole in the work to be transferred. Steel thimbles are used to increase the diameter of the plug to correspond to the work. In accuracy, the tool will be found entirely satisfactory and it will save considerable time.

Rebuilding Old Pistons with Bronze

A western machine-shop owner has found that he can build up old pistons on "orphan" cars with welding bronze and has proved it to be a very satisfactory method of getting an oversize piston. The method used is to clean the piston carefully with a file or a grinding wheel, as any scale or dirt will prevent the bronze from adhering properly and will result in a poor job. It is then heated to a cherry red, to burn out all the oil that might remain in the pores of the iron, as any oil remaining will cause bubbles in the bronze, which is then applied until it is thick enough to permit turning the piston down to a smooth job. This process does not pay in the smaller sizes of pistons that can be obtained at a moderate price, but is used in cases where pistons are expensive and hard to get. Another feature of these rebuilt pistons is that they do not score the cylinder walls when the engine becomes overheated. This was discovered when an air-cooled engine became overheated, due to improper functioning of the cooling system, and the piston froze. An investigation showed that the piston and cylinder wall were not damaged in the least, and after a few minor repairs to other parts of the engine, it worked as well as ever. Valve ports can also be built up with bronze in this way.—L. A. Krider, Coeur D'Alene, Idaho.

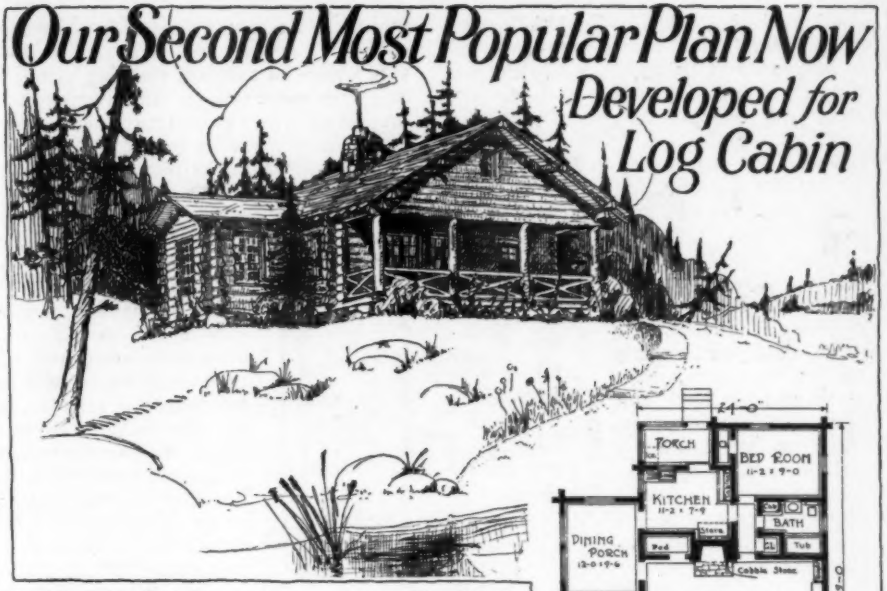
Novel Swinging Sign

Swinging signs of the kind shown in the drawing have their advantages in that their movement attracts attention, and they offer less resistance to a high wind than stationary signs, for which reason they are not wrecked as easily as the latter.

Movement of Swinging Signs Draws Attention of Passing Motorists

The sign itself is pivoted to the top of two stout poles or posts.—Leon I. Thomas, Oak Park, Ill.

Our Second Most Popular Plan Now Developed for Log Cabin



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Plan 61-L-C

NOW that good roads and high-speed automobiles make woods and lakes accessible in a few hours from so many big cities, summer cottages and log cabins are not only growing a lot more popular but are used for longer periods each season. Furthermore, many a summer-cottage or cabin plan can, without much expense, be converted into a mighty comfortable, good-looking permanent small home for town, city or countryside.

That's exactly what happened in this case. This plan, originally designed for a summer cottage, was finished as a year-around house. The owner built it on the shore of a lake not far from a big city, and liked it so well he has lived in it ever since, enjoyed lower taxes, better health, and it cost only $2,500 complete.

With the exception of one other plan, this design (61-L-F) has been the most popular with Popular Mechanics readers the past year. And so we thought, at this time of the year when many people are planning summer cottages and cabins, you would be glad to see it in real log-cabin style. It may be the ideal plan for your summer camp.

Plan 61-L-F

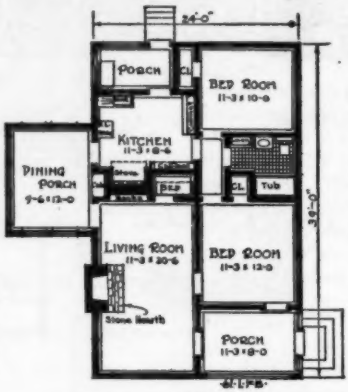
Generally speaking, a log cabin or summer cottage

HOW TO GET THE PLANS

One-sheet blueprints for this house in log-cabin style or as a permanent house for town or city, may be had for $1.00 each. This blueprint does away with the necessity of first buying a complete set of plans to find out whether you can afford to build. It contains floor plans, elevations, a section, detail, size of joists, studs, etc. Submit them to local dealers and builders for cost information. Specify whether 61-L-C (the log cabin), 61-L-F (the original floor plan) or 61-L-F-B (the alternate plan) is desired.

need not be large, but it should be roomy. By adopting a dual-purpose plan, you can quickly convert living space into sleeping quarters. You also need reasonable comfort and convenience, and protection against tolerably cold weather. Then there is the appearance and style which many folks are now giving a lot of attention. Few are content these days with what was once called a summer shack.

There are, of course, various ways to build a log cabin. Real logs are picturesque and romantic. Unless you live in a timber country, they mean a long haul and considerable expense. However, you can get a satisfactory log effect by using the new forms of wide siding, sawed in quarter and half-round to look like logs. Another rustic and satisfactory exterior finish is rough siding stained brown. Shakes and large shingles used as outside finish produce that semi-crude, but sturdy quality most people prefer in cabins.



FIRST FLOOR PLAN
ALTERNATE "B"

Let's look into the construction of this log cabin and the equipment. A fifty-foot frontage is required. Footings are concrete. Logs are six and seven-inch tops, calked with oakum. The base course is of cobblestones. Omitting this will save money. The roof is of log rafters with four-and-one-half-inch tops, overlaid with surfaced pine boards and then covered with wood or composition shingles. Log joists for the floors have eight-inch tops, on which is laid the subfloor and then felt or fiber insulation, and finally a finished floor of pine.

Interior partition walls are pine boards on two by four-inch studs. Casings for doors are half logs. Doors throughout are matched plank of one-and-three-fourths-inch pine with half-log battens. The fireplace is made of cobblestones with flagstone hearth. Floors throughout are pine, except the kitchen which is covered with linoleum.

Now about equipment and dual-purpose space. A closet next to the fireplace may contain a roller-type bed. The front porch may be used for sleeping purposes by one or more people. In an emergency, the dining alcove or sun room can be converted into sleeping quarters. A bathroom is shown in the plan. If the cabin is only a skeleton and temporary in service, the space occupied by the bathroom can be made into a bunk room for boys.

At small expense, you can convert this house into a permanent town or city home. A partial-basement excavation with small heater will be satisfactory. Insulation for the walls, roof and floors will be necessary. Inside finish may be wallboard or lath and plaster.

An alternate plan shows how a second bedroom may be had, and if the family is small and a bedroom is rented, the occupant may enter his room through a door from the porch.

This house may be finished in logs, stucco, shingles or siding, or it can be built of brick. As a log-cabin plan or permanent home, you will look a long time to find a more flexible, roomy, convenient arrangement in so small space and at so reasonable a price.

One reason for the popularity of this house is the ease with which the interior can be altered to suit any taste and needs. The alternate plan on this page is only one of many arrangements that are easily made. A contractor can take the exterior and work out for the prospective builder any desired combination of rooms. Because of its simple roof lines, the house also is easily changed in size.

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